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AUGUST 15, 1956

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Turn the page for a Quick Look at this issue ▸

a *QUICK LOOK* at this issue . . .

BUSY OIL MEN: To help you put first things first, scan these time-saving digests on this and the following page on developments

IN RUSSIA . . .

WORLD OIL is proud to present in this special International Outlook Issue what is the latest and most complete report available on Russia and its satellite countries. Groundwork for this presentation was laid more than two years ago by Publisher Ray L. Dudley, who felt that oil men would welcome an opportunity to acquaint themselves with the petroleum industry in the Communist world so they could evaluate its importance for themselves.

To succeed in gathering this material, WORLD OIL sent an editorial representative to Moscow and arranged for articles to be written by experts who have kept close contact with the satellite countries through their own means. In addition, WORLD OIL's international desk corresponded at length for two years in directing and assisting its European correspondents, who must remain anonymous, in preparing thorough-going reports on Russia and the satellites.

Beginning with the detailed report on Russian oil by Dr. J. Brian Eby, internationally known geologist from Houston, who recently returned from a visit to Russia in WORLD OIL's behalf (see Page 174), the special report on the Communist world covers 34 pages of closely edited but detailed data on every country in the Soviet orbit.

As Dr. Eby points out at the beginning of his article, USSR oil production has risen steadily since World War II, and reached during 1955 a daily average of in excess of 1.4 million barrels—which includes both crude oil and liquid hydrocarbons.

A particularly interesting topic discussed by Dr. Eby is the Russian turbodrill. Accompanying this discussion is a photograph (page 175).

A further report on Russia (Page 180) emphasizing drilling rates and domestic consumption of crude products, which is estimated to have reached almost 1.4 million barrels in 1955, and a report on the expansion called for under Russia's Sixth Five-Year Plan combine to offer a succinct summary of the nation's oil business.

The section devoted to Russian satellites includes a map-illustrated article describing the probability of the discovery of new producing zones in the Lovaszi field of Hungary (Page 188) and the emergence of the Nagylengyel field as the nation's No. 1 crude producing area.

Highlighting a report on Poland (Page 191) is a map pinpointing the nation's producing areas, which produced an estimated 2 million barrels plus last year. Failure to reach the prescribed quota has been attributed to lack of drilling.

Also appearing in this section are articles dealing with the doubtful future facing Rumanian oil (Page 194); how Czechoslovakia's oil industry is suffering from the lack of interest exhibited by Russia (Page 198); natural gas in East Germany, which holds the area's best immediate hopes for the future (Page 200); Albania's production rise to an estimated 1,870,500 barrels in 1955 (Page 202); the extent to which the Soviet Union is exploiting Bulgaria (Page 206); and where the accelerated exploration rate in Yugoslavia is occurring (Page 204).

IN CANADA . . .

The Canadian section—also a special feature in this issue—offers a detailed analysis of the general progress, trends and economics of the burgeoning Canadian petroleum industry. This year's expanded section includes a close-up of industry operations, including crude oil and natural gas production and prospects, as well as the drilling trend and prospects (Page 155).

Additionally, the Pembina field, Canada's No. 1 producing area, is evaluated from the standpoint of reserves (about 600 million barrels), pressure decline (due to the oil being under-saturated), field limits and secondary recovery practices (Page 165).

On Page 168, a summary discussion of all 1955 Western Canadian discoveries may be found.

IN THE U. S. . . .

The 1956 outlook in the U. S.:

- Crude production to average approximately 7,210,100 barrels a day in 1956.
- The drilling of 59,400 wells.
- Demand to reach 9,256,000 barrels daily.

Thus, 1956 is expected to be a record shattering year for the domestic oil and gas industry.

The WORLD OIL mid-year drilling forecast of 59,400 wells in the U. S. shows a significant gain from 55,879

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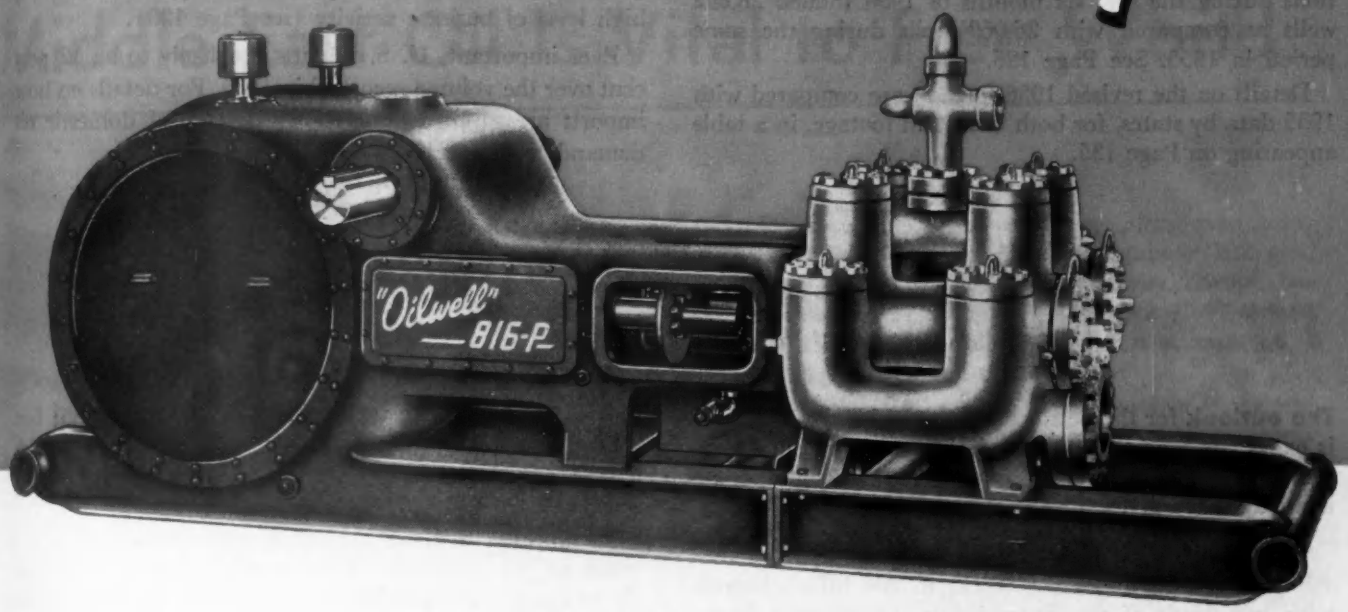

This new 16" stroke pump, designed for high-pressure drilling, is a worthy companion to "Oilwell's" 818-P pump which has been enthusiastically received by drillers during the past three years.

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Piston Size (Inches)	Maximum Working Pressure (psi)	Gallons (per rev.)	Displacement gpm at pump speeds (rpm) of:					
			30	40	50	55	60	65*
8	1,197	13.11	393	524	655	721	786	852
7¾	1,280	12.24	367	490	612	674	735	796
7¼	1,478	10.61	318	425	531	584	637	690
7	1,593	9.85	295	394	493	541	591	640
6¾	1,725	9.10	273	364	455	500	545	591
6½	1,875	8.37	251	335	419	460	502	544
6	2,235	7.01	211	281	351	386	421	456
5½	2,725	5.76	173	230	288	317	345	374
Pinion Shaft—rpm.....			137	183	228	251	274	297
Brake Horsepower Required.			323	431	538	592	646	700

*Higher speed and horsepower permissable with favorable suction conditions.

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completions in 1955 and only 43,307 wells during 1950. This expanded drilling program is expected to result in the drilling of 243 million feet of hole in comparison with 228½ million feet in 1955, and 159¾ million feet during 1950.

The heavy drilling rate during the first half of the year exerted a strong influence on the forecast. U. S. completions during the first six months of 1956 totaled 28,892 wells as compared with 26,069 wells during the same period in 1955. See Page 133.

Details on the revised 1956 forecast are compared with 1955 data by states, for both wells and footage, in a table appearing on Page 135.

Crude production in the U. S. will average about 7,210,100 barrels a day this year, WORLD OIL forecasts. For the impact of imports on this output, as well as an illustration depicting the relative role of the eight states which produce 90 percent of U. S. oil, see Page 131.

The growth in demand for oil in the U. S. is somewhat above the normal, and is predicated on the continuing high level of business activity (see Page 129).

Ever important, U. S. imports are likely to be 12 percent over the volume recorded in 1955. For details on how imports are supplying increasing portion of domestic oil demand, see Page 136.

THE WORLD . . .

The outlook for the petroleum industry outside the U. S. is extremely bright. A spectacular recent expansion of oil industry operations abroad is expected to continue unabatedly through 1956.

- Reserves—growth of 46 billion barrels in 1955 shoves the proved reserves of the world to 200 billion barrels, with two-thirds of the figure being concentrated in the Middle East. See Page 122.

- Demand—the consumption of 21½ million barrels of crude daily by 1960 is envisioned. That is tantamount to 5 million barrels more than the 1955 total.

- This significant rise in demand is occasioned by the tremendous growth in motorized travel, mechanized farming and industrial operations. See Page 127.

- Drilling—a total of 67,610 wells, of which 8210 are expected to be drilled outside the U. S., is forecast for 1956, up 3952 wells from 1955. See Page 141.

- Production—with a major assist from the Middle Eastern oil producing countries, world crude output last year emerged with a 12.1 percent increase from 1954 for a new record annual total of 5,640,894,000 barrels. See Page 143.

In addition to these statistical reports, the section devoted to the discussion of global oil activities includes a list of current independent oil companies and U. S. drilling contractors engaged in operations outside the U. S. The reason for this expanding trend is discussed on Page 138.

For these operations to continue, operators must give precise planning to their supply lines. Turn to Page 152 for reasons why company-operated warehouses are nerve centers of operations throughout the world of oil, except, of course, in the U. S. and Canada where supply stories are located at convenient and strategic points.

If you have ever wondered where the world's deepest wells are located, the article on Page 151 will salve your curiosity. A survey of 76 countries shows the range of drilling depth records in the countries extends from 22,570 feet in the U. S. to only 1995 feet in New Caledonia.

ALSO IN THIS ISSUE . . .

- **A large-scale, multi-colored map showing the oil and gas fields, pipe lines and refineries in Canada is inserted in this issue.**

- **A Quick Look at oil and gas developments in individual countries around the world appears on Pages 210 and 211.**

Middle East Oil Is Vital to Free World

Access to Middle East oil is absolutely essential to the welfare of the Free World today. Oil circles talk of surplus supplies today. There is fear that a flood of Middle East oil will drown international markets. Seldom is there any mention that Middle East oil is vital to the Free World.

The truth of the matter is that the Free World cannot do without Middle East oil, even today. Otherwise, the economy of a large section of the Free World would suffer irreparable permanent damage over-night.

Middle East oil will become far more necessary to the Free World in future years. In time, and not too long a period of time, most of the world is going to become dependent upon the vast oil resources of the Middle East for sufficient supplies.

In time of war, Middle East oil would be of even greater necessity to the Free World.

The current Suez Canal controversy, therefore, is a crucial matter. Three-fourths of the Middle East oil moves to international markets through this narrow 100-mile channel. Egyptian control of the Suez Canal would make it possible for Egypt to stop the movement of vast quantities of Middle East oil to Europe at any time it desired to do so. Therefore, Egypt would control the destiny of much of the Free World if it controls the Suez Canal. Pipe lines might be built from the oil fields to the Mediterranean Sea to by-pass the Suez—if the other Arab nations would permit.

•

At this very moment, the Free World would not have sufficient supplies to satisfy its present peacetime needs without Middle East oil. Currently, more than 3 million barrels of Middle East oil are going to Free Nations every day (see Page 148). Much of it moves through the Suez Canal, mostly to Europe, but also to other regions including the United States.

Right now the U. S. could get along without imports from the Middle East. It could increase its own domestic production and depend more upon Venezuelan oil. However, before too long, even the U. S. is going to need Middle East oil to satisfy its increased future needs.

Europe, however, could not get along even today without Middle East oil. The postwar has seen the economic well-being of Western Europe become dependent upon oil. This region now imports more than 2 million barrels per day, most of it from the Middle East.

The economy of many other parts of the world now are more dependent upon an adequate supply of petroleum than ever before. Again, the Middle East is supplying essential quantities to these areas, hence is vital.

•

In the future Middle East oil will be of even greater importance to the Free World.

By 1960, world demand for petroleum products is likely to exceed 21 million barrels daily, 5 million more than 1955 consumption. (See Page 125.) If present growth rates continue, world consumption will double by 1975.

Without the Middle East there would be no hope of satisfying such increases in demand. Progress of the world would be retarded. Estimates place Middle East crude reserves anywhere from 133 billion to 306 billion barrels. Even the smaller figure represents two-thirds of the world's total. (See Page 122.)

This concentration of so much of the world's reserves in the Middle East makes the rest of the world dependent upon it for future supplies. As time passes, the Free World will become increasingly dependent upon the vast oil resources of the Middle East.

•

Only with access to Middle East oil can the Free World hope to satisfy the greatly expanded oil demands that will be faced in the future. Therefore, accessibility of Middle East oil is absolutely vital to the welfare of the Free World.

Warren L. Baker

U. S. OIL PROSPECTS ARE GOOD FOR LAST HALF OF 1956

TOTAL DEMAND FOR ALL OILS	Expected to average 9,305,000 barrels daily in second half, 99,000 higher than first half and 441,000 above 1955. Forecast for full year 9,256,000 barrels, up 475,000 from 1955.
CRUDE OIL PRODUCTION	Is likely to average 7,264,000 barrels daily in last half, 108,000 above first half and 426,500 above 1955. Forecast for full year is 7,210,000 barrels, up 403,000 from 1955.
NEW WELLS DRILLED	59,400 wells are forecast for the year, 3,521 above 1955 rates. This means drilling of 30,508 wells in last half, 698 above 1955 and 1,616 more than in first half of 1956.
FOOTAGE DRILLED	Nearly 243 million feet forecast for year, 14½ million above 1955. Last half to see 125½ million feet drilled, 3 million above 1955, and 8 million feet over first half.

New Peaks Ahead for U. S. Oil . . .

Greatest demand, crude production and drilling activity in history will be experienced during the last half of 1956.

RECORD-BREAKING demand for oil will provide the petroleum industry of the U. S. with favorable operating conditions during the last half of 1956. It will make possible the production of more oil than ever before, despite peak imports and present large stocks of gasoline. Hence, producers will be encouraged to engage in a peak volume of drilling.

Record Demand. Sharp growth during the first half of the year assures another substantial gain in U. S. oil demand. Total demand for all U. S. oils averaged 9,206,000 barrels daily during the first six months of 1956, an increase of 5.9 percent or 510,000 barrels over the same period of 1955.

WORLD OIL forecasts total demand at 9,305,000 barrels per day during the last half of 1956. This would be 5.0 percent, or 441,000 barrels, more than in 1955; and 99,000 barrels per day higher than experienced in the first six months of 1956.

The outlook for the last six months combined with first half volumes indicates total demand for all U. S. oils will average 9,256,000 barrels during the full year, an increase of 475,000 barrels or 5.4 percent (See Page 129).

Big Production Gain. Demand will be sufficiently above all previous years to permit record domestic production of crude oil, despite greatest imports in history.

Crude production of 7,264,000 barrels per day during the last half of 1956 is forecast by WORLD OIL. This would be 108,000 more than in the first half of the year, and 426,500 barrels a day or 6.2 percent above the last 6 months of 1955.

Consumption will permit this volume of U. S. production, if imports do not exceed an average of 1,425,000 barrels per day during the remainder of 1956. This would contrast with the importation of an average of 1,385,000 barrels per day during the first half of the year.

Production for the full year is thus forecast at 7,210,000 barrels daily, an increase of 403,000 or 5.9 percent over 1955. (See Page 131).

Peak Drilling. With crude prices likely to undergo little change, higher producing volumes will boost income of producers. This will provide additional incentive for increased drilling activity. Record rates were attained in the first half of the year, causing WORLD OIL to forecast the drilling of 59,400 wells and 243 million feet of hole during 1956 in the U. S. (See Page 133). This is 3521 more wells and 14½ million more feet of hole than drilled during 1955.

The 1956 forecast calls for the drilling of 30,508 wells and 125½ million feet of hole during the last six months of the year. This would be only 698 more wells than in the last half of 1955, and 1616 more wells than drilled in the first six months of 1956.

The increase would be greater were it not for material shortages growing out of the recent steel strike.

OPERATIONS OUTSIDE OF U. S. TO HIT NEW PEAKS IN 1956

Another sharp increase is expected to boost daily average outside of U. S. to 8,650,000 barrels in 1956, a gain of 997,000 barrels, or 13.0 percent, over 1955's peak volume.	TOTAL DEMAND FOR ALL OILS
Outside of U. S. likely to average 9,600,000 barrels daily during 1956, a gain of 952,000 over 1955. This would mean a world total of 16,810,000 barrels, 1,355,000 above 1955.	CRUDE OIL PRODUCTION
8,210 wells, 431 more than during 1955, are expected to be completed outside of U. S. in 1956. Western Canada seen as the site for 2,945 of these wells, one-third of total.	NEW WELLS DRILLED
Is likely to reach nearly 35 million feet outside of U. S. during 1956, almost 2 million more than in 1955. Western Canada to account for about 13 million feet of this total.	FOOTAGE DRILLED

. . . Sharp Growth Seen Outside U. S.

All previous records for demand, production and drilling activity will be exceeded by substantial margins in 1956.

THE OUTLOOK for oil outside of the U. S. is very bright. The spectacular recent growth for the petroleum industry outside of the U. S. is to continue at an unabated pace during 1956.

With far more oil due to be consumed than ever before, crude oil production will rise sharply, and drilling operations will reach new peaks.

Big Consumption Growth. Another huge increase in the use of oil is taking place outside of the U. S. this year. Again, the rate of growth is to exceed that of the U. S.

At midyear it appeared that the demand for oil outside of the U. S. would average 8,650,000 barrels per day during 1956. This would be almost 1 million barrels a day, or 13 percent, larger than in 1955, and nearly 2 million barrels above two years ago. This means that oil demand outside of the U. S. has almost doubled since 1950.

Within a few years the rest of the world will be consuming more oil than the U. S. (See Page 148).

Addition of anticipated U. S. demand to that of the rest of the world boosts probable 1956 total world oil demand to 17½ million barrels daily, 1½ million barrels above 1955 and 3 million barrels greater than in 1954.

Greater Production. Crude oil production also has grown at a faster pace in the rest of the world than in the U. S. during recent years. A similar trend will exist in 1956.

Daily average crude oil production outside of the U. S. is likely to reach 9,600,000 barrels during 1956, an increase of 952,000 barrels over 1955. To reach this average for the full year, it is anticipated that producing rates will exceed 10 million daily before the end of the year.

Much of the increase, of course, will come from the huge Middle East fields.

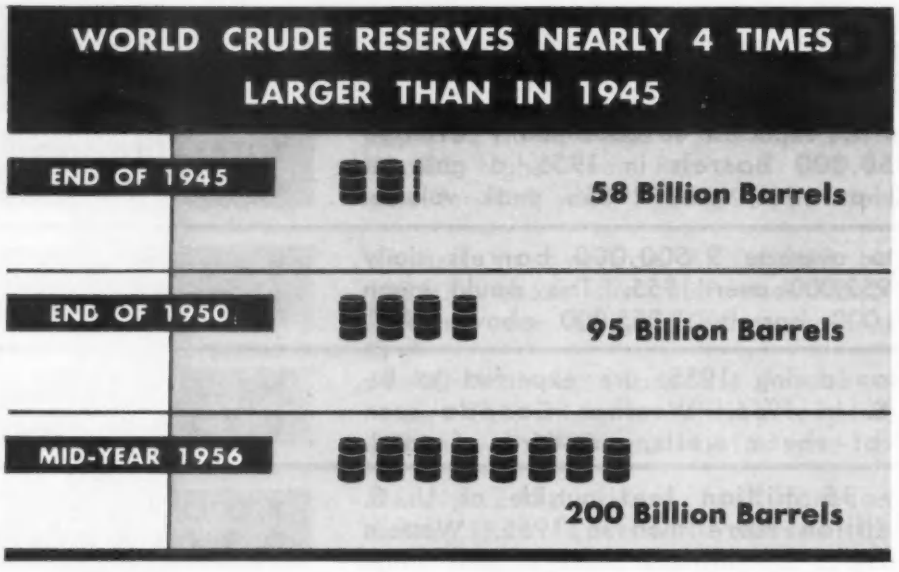
Increased production in both the U. S. and elsewhere will result in total world crude production rising to an estimated 16,810,000 barrels daily during 1956. This would be 1⅓ million greater than in 1955.

Higher Drilling Rates. Further expansion of drilling is forecast for 1956. WORLD OIL estimates that 1956 will see 8210 new wells drilled in the Free World areas, exclusive of the U. S. This is 431 more than drilled in 1955. (See Page 133).

Footage is expected to climb from 33 million feet in 1955 to nearly 35 million feet during 1956.

Western Canada should account for more than one-third of all drilling outside of the U. S. A total of 2945 wells is predicted for Western Canada during 1956, compared with 2766 during 1955. Footage in Western Canada is likely to amount to about 13 million feet. Bulk of Western Canada's drilling will be in the last half of the year, the first six months seeing the completion of only 1142 wells.

Venezuela will follow with completion of an estimated 1200 wells in contrast with 1163 wells in 1955.



Another Big Increase Occurs In World Crude Oil Reserves

Growth of 46 billion barrels during the past year pushes proved reserves to 200 billion barrels, two-thirds of which is concentrated in the Middle East.

No OIL SHORTAGE is in sight, despite rapid gains in consumption. Known unproduced crude oil reserves of the world continue to rise sharply, and additional gains apparently are in sight.

However, so much of the recent reserve growth has been concentrated in the Middle East, the rest of the world is becoming increasingly dependent on this region for adequate supplies to meet higher future needs.

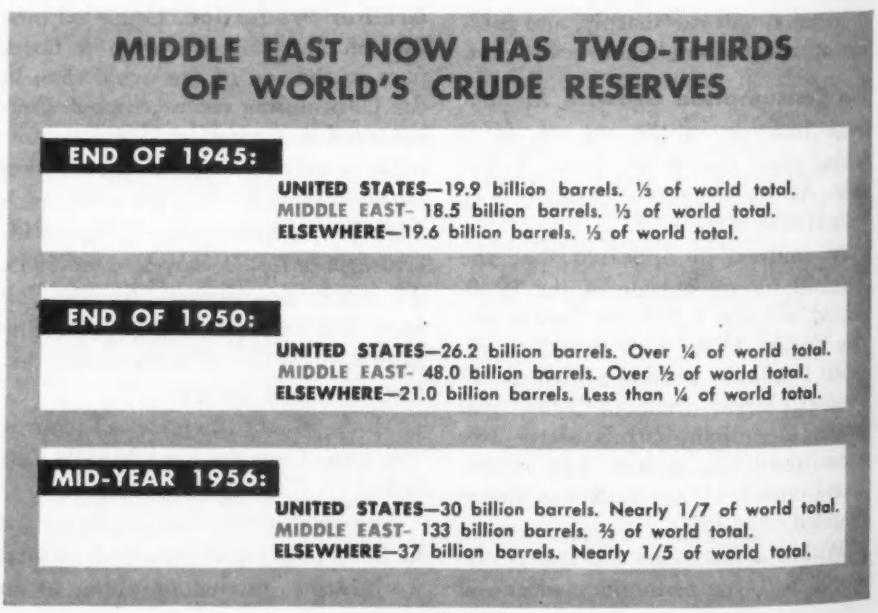
Proved reserves of crude oil are estimated to have increased by 46 billion barrels during the past year. A mid-1956 study by WORLD OIL indicates known unproduced oil reserves of the world now total 200 billion barrels, nearly 1/3 larger than the 154 billion barrels indicated by a similar study in mid-1955.

Today's world reserves of 200 billion barrels are more than double the 95 billion barrels estimated to have existed at the end of 1950, and are almost four times greater than 1945 reserves.

Shift to Middle East. The huge increase is the result of a tremendous growth in Middle East reserves. This has resulted in a sensational relocation of the world's reserves.

In 1945, the Middle East had 1/3 of the world's reserves, the U. S. 1/3 and the remainder of the world 1/3. Today, the Middle East has 2/3 of the world's reserves, the U. S. only 1/7, and the rest of the world less than 1/5.

The current Middle East reserve figure is conservatively estimated at


MIDDLE EAST NOW HAS TWO-THIRDS OF WORLD'S CRUDE RESERVES
END OF 1945:
UNITED STATES—19.9 billion barrels. ⅓ of world total.
MIDDLE EAST- 18.5 billion barrels. ⅓ of world total.
ELSEWHERE—19.6 billion barrels. ⅓ of world total.
END OF 1950:
UNITED STATES—26.2 billion barrels. Over ¼ of world total.
MIDDLE EAST- 48.0 billion barrels. Over ½ of world total.
ELSEWHERE—21.0 billion barrels. Less than ¼ of world total.
MID-YEAR 1956:
UNITED STATES—30 billion barrels. Nearly 1/7 of world total.
MIDDLE EAST- 133 billion barrels. ⅔ of world total.
ELSEWHERE—37 billion barrels. Nearly 1/5 of world total.

World Crude Reserves

Reserves estimated by WORLD OIL with aid of oil companies and other sources.
(Thousands of Barrels)

Continent and Country	RESERVES			Production in 1955		Ratio of Reserves to 1955 Production
	Mid-Year 1955	Mid-Year 1956	Percent of World in 1956	Thousands of Barrels	Percent of World	
North America	**34,202,500**	**35,753,500**	**17.83**	**2,703,715**	**47.93**	**13.2**
Alaska	500	500	....	.....	....	....
Canada	2,400,000	3,000,000	1.49	129,452	2.29	23.2
Cuba	2,000	3,000	....	382	0.01	7.9
Mexico	2,000,000	2,500,000	1.25	89,360	1.58	28.0
United States	29,800,000	30,250,000	15.09	2,484,521	44.05	12.2
South America	**12,377,500**	**14,048,000**	**7.01**	**910,160**	**16.13**	**15.4**
Argentina	300,000	350,000	0.18	30,457	0.54	11.5
Bolivia	30,000	70,000	0.03	2,692	0.04	26.0
Brazil	35,000	33,000	0.02	2,014	0.04	16.4
Chile	40,000	50,000	0.02	2,577	0.04	19.4
Colombia	525,000	525,000	0.27	39,363	0.70	13.3
Ecuador	23,500	25,000	0.01	3,531	0.07	7.1
Peru	225,000	225,000	0.11	17,246	0.30	13.0
Trinidad	280,000	270,000	0.14	24,896	0.44	10.8
Venezuela	10,919,000	12,500,000	6.23	787,384	13.96	15.9
Europe, Western	**753,000**	**2,626,000**	**1.31**	**63,707**	**1.13**	**41.2**
Austria	237,000	630,000	0.32	24,886	0.44	25.3
France	75,000	1,500,000	0.75	6,409	0.12	234.0
Germany	337,000	360,000	0.18	22,345	0.39	16.1
Great Britain	4,000	5,000	....	394	0.01	12.7
Italy and Sicily	10,000	21,000	0.01	2,536	0.04	8.3
Netherlands	90,000	110,000	0.05	7,137	0.13	15.4
Europe, Eastern	**10,731,000**	**11,268,000**	**5.62**	**618,815**	**10.97**	**18.2**
Albania	30,000	23,000	0.01	1,871	0.03	12.3
Bulgaria	1,000	1,000	....	.....	....	....
Czechoslovakia	9,000	9,000	0.01	1,117	0.02	8.1
Hungary	144,000	140,000	0.07	10,970	0.20	12.8
Poland	22,000	20,000	0.01	2,800	0.05	7.1
Rumania	400,000	550,000	0.27	78,588	1.39	7.0
U.S.S.R. (Including Asia)	10,100,000	10,500,000	5.24	521,733	9.25	20.1
Yugoslavia	25,000	25,000	0.01	1,736	0.03	14.4
Africa	**115,000**	**319,500**	**0.16**	**13,932**	**0.25**	**22.9**
Algeria	5,000	2,000	....	434	0.01	4.6
Egypt (Including Sinai)	100,000	300,000	0.15	12,740	0.22	23.5
Morocco	10,000	7,500	....	758	0.02	9.9
Other Africa	.....	10,000	0.01	.....	....	....
Asia, Total	**96,099,200**	**136,415,475**	**68.07**	**1,330,542**	**23.59**	**102.5**
Asia, Middle East	**93,265,000**	**133,201,800**	**66.46**	**1,180,187**	**20.92**	**112.9**
Bahrain	235,000	175,000	0.09	10,982	0.19	15.9
Iran	13,000,000	26,000,000	12.97	120,137	2.13	216.4
Iraq	14,500,000	15,000,000	7.49	246,479	4.37	60.9
Israel	.....	1,800	....	.....	....	....
Kuwait	27,500,000	50,000,000	24.94	398,494	7.07	125.5
Neutral Zone	400,000	390,000	0.20	8,848	0.15	44.1
Qatar	1,500,000	1,500,000	0.75	41,808	0.74	35.9
Saudi Arabia	36,000,000	40,000,000	19.95	352,240	6.25	113.6
Trucial Coast	50,000	50,000	0.03	.....	....	....
Turkey	80,000	85,000	0.04	1,199	0.02	70.9
Asia, Far East	**2,834,200**	**3,213,675**	**1.61**	**150,355**	**2.67**	**21.4**
Burma	45,000	43,500	0.02	1,618	0.03	26.9
China	30,000	200,000	0.10	13,200	0.23	15.2
India	47,000	50,000	0.03	2,526	0.04	19.8
Indonesia	2,100,000	2,300,000	1.15	85,921	1.53	26.8
Japan	30,000	30,000	0.01	2,229	0.04	13.5
New Guinea	60,000	60,000	0.03	3,418	0.06	17.6
Pakistan	22,000	20,000	0.01	2,068	0.04	9.7
Sarawak-Brunei (Br. Borneo)	500,000	510,000	0.25	39,351	0.70	13.0
Taiwan (Formosa)	200	175	....	24	....	7.3
Australia-New Zealand	**1,000**	**1,000**	....	**23**	....	**43.5**
TOTAL, WORLD	**154,279,200**	**200,431,475**	**100.00**	**5,640,894**	**100.00**	**35.5**

133 billion barrels. All the rest of the world has only 67 billion barrels, of which 30 billion is in the U. S., and 37 billion barrels elsewhere.

Thus the Middle East is now entrenched to such an extent as the world's foremost oil province, it is unlikely to ever be displaced by another area. Large quantities of additional oil will continue to be found in other parts of the world in coming years. However, gains in consumption will be so great that an increasing portion of the world must come to depend upon the tremendous oil resources of the Middle East for adequate supplies.

Wide Variance in Estimates. Attention was focused on the question of how much known crude reserves currently exist by two news-making estimates during the past year. Both works were by highly reputable geologists, but their estimates were far different.

G. M. Knebel and Guillermo Rodrigues-Eraso, Standard Oil Company (New Jersey), presented a study in the fall of 1955 which stated that the Free World had a known ultimate recovery of approximately 263 billion barrels (WORLD OIL, Page 98, May, 1956). This figure would be raised to 283 billion barrels by the addition of 20 billion barrels for Soviet Russia and its affiliated countries. Since the world had a cumulative production of approximately 90 billion barrels at the end of 1955, this would indicate remaining proved reserves of approximately 193 billion barrels, very close to the 200 billion barrels used in WORLD OIL's current study.

On the other hand, Wallace Pratt, former chief geologist for Standard Oil Company (New Jersey), in March, 1956, presented figures to a Congressional committee that gave world crude reserves of 306 billion barrels at the end of 1954. Out of this total, Pratt credited the Middle East with 230 billion barrels of reserves. While estimating reserves at a far higher figure than used previously, Pratt insisted that his estimates were conservative and constituted only "proved" reserves.

It is likely that time will ultimately prove Pratt's figures to be right. His estimates probably are just a little premature. This is particularly true of the Middle East. There can be little doubt that Middle East reserves will be increased very substantially in coming years, and someday it may be widely agreed that they aggregate 230 billion barrels. The vast discoveries made to date indicate no reserve estimate is beyond the realm of possibility for the Middle East.

Further Middle East Gains. Already additional reserves are in sight which will increase the Middle East above the 133 billion barrels credited in WORIL OIL's current study.

A major discovery appears to be in the making at Raudhatain, in northern Kuwait. A number of oil zones have been proved. They may be equivalent to the very prolific Burgan sands productive to the south and to the Zubair zone productive to the north. At least 1200 feet of pay section was reported.

Still another major discovery looms at Kharsaniya on the Saudi Arabian coast. This well flowed at the rate of 2200 barrels of oil on a drill stem test from 5924-76 feet. In early July, the well was still coring in the Arab Zone at 6168 feet. The structure is believed to be another big one.

Neither the Raudhatain or Kharsaniya discoveries have entered into WORLD OIL's present figures. They remain to be evaluated by additional drilling. However, they serve to stress the point that no end to increases in the Middle East reserves is in sight, and that further vast growth can be expected in the foreseeable future.

Many Nations Have Big Gains. Much of the 46 billion barrel growth indicated for the past year was credited to the Middle East. However, several countries in other parts of the world also recorded substantial increases.

The tiny Middle East Sheikdom of Kuwait leads the world in reserves with a whopping 50 billion barrels, although it has only three fields and but 185 wells currently producing. Each field, however, has a 1000-foot sand pay section. Total producing area of the three fields amounted to 138,240 acres at the beginning of 1956.

Saudi Arabia ranks second with 40 billion barrels of reserves. No doubt this is a very conservative estimate. Biggest Saudi Arabia development of the past year was the proving that Ghawar field is a continuous reservoir 130 miles long, covering approximately 1 million acres. In view of this development and the existence of other giant fields in the country, a reserve of 40 billion barrels seems to be a rock bottom figure for Saudi Arabia, although Arabia American Oil Company's annual report for 1955 set reserves at between 30 and 35 billion barrels.

In third place is the U. S. with slightly over 30 billion barrels of known crude reserves. Practically no change occurred in U. S. reserves during the past year.

Another Middle East country ranks fourth. Iran, making a fast recovery following reopening of its fields, is credited with reserves of 26 billion barrels. The favorable reaction of fields to the long shut-in period prompts an increase in this country's reserves. Generally, pressures in Iranian fields equalized nicely during the shutdown, and wells have responded normally upon being reopened.

In South America, the Venezuelan government places crude reserves at 12½ billion barrels. Bolivia rose sharply to 70 million barrels, chiefly due to development of the Camari field.

Lifting of the Iron Curtain from Austria reveals that the Matzen-Auersthal field is 8 miles long and 6 miles wide and that its oil fields are in better shape than expected. As a result Austria's reserves have been placed at 630 million barrels.

The Parentis field in France has been proved a major one, with 6000 or more productive acres. As a result, French reserves have been boosted sharply to 1½ billion barrels.

Canadian reserves have been increased to an estimated 3 billion barrels, ¼ more than a year ago.

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World's Demand for Oil Will Rise Sharply Within Next Five Years

Consumption of 21.5 million barrels daily by 1960 is likely. This is more than 5 million barrels over 1955 figure.

THE PHENOMENAL recent growth of the oil industry will continue in coming years. World consumption of petroleum products is likely to reach nearly 21½ million barrels per day by 1960. This would be one-third greater, or almost 5½ million barrels daily above the 1955 record volume, double the 1950 rate, and three times larger than in 1946 when world consumption amounted to only 7¾ million barrels per day.

Oil consumption needs to grow at only slightly larger than recent growth rates to attain such a volume by 1960. The almost 5½ million barrel increase anticipated for the period between 1955 and 1960 compares with a 5-million-barrel rise during the last five years.

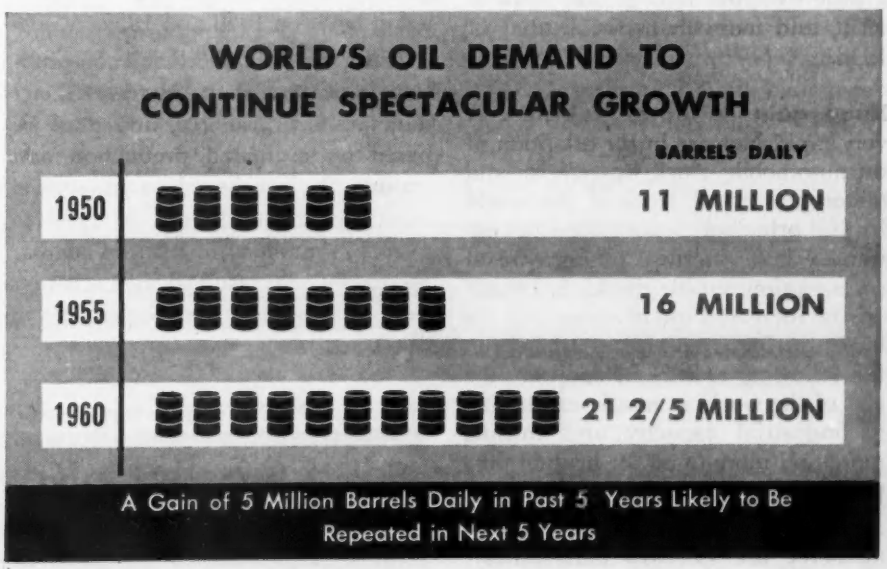
Number of automobiles, trucks, buses, airplanes, tractors and motorcycles is expanding at a faster pace than ever before. Industrial capacity is increasing at the sharpest rate in history, and more oil is being used for heating of homes and plants. Growth in all these phases is especially rapid outside the U. S. These trends are expected to continue in the years ahead. They promise vastly enlarged oil consuming rates.

To provide sufficiently enlarged supply to satisfy such a large increase in oil demand will require that the industry continue to invest heavily in new wells, plants and equipment. Production, transportation and refining capacities all will need to be expanded. Despite present surplus producing ability, production can be increased by such magnitude only by means of enlarged drilling rates and the installation of new producing facilities.

Biggest growth outside of U. S. Demand for oil has been growing at a faster pace outside the U. S. during recent years. In line with this trend, a larger rate of growth will be shown outside the U. S. during coming years. By 1960 the rest of the world is expected to be consuming more oil than the U. S., although the latter accounted for nearly two-thirds of the oil used by the world in 1946.

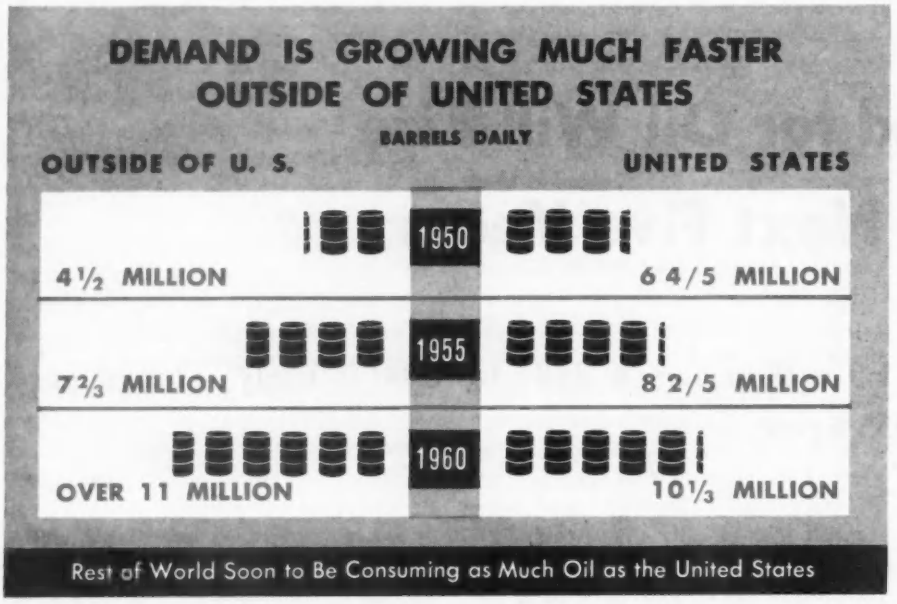
Demand outside the U. S. is seen as exceeding 11 million barrels per day by 1960. At that time, the U. S. is expected to be using 10 1/3 million barrels per day.

The consumption forecast for 1960 calls for an increase outside of the U. S. of 3½ million barrels or one-half more than the 1955 volume. Dur-


WORLD'S OIL DEMAND TO CONTINUE SPECTACULAR GROWTH
BARRELS DAILY
1950
11 MILLION
1955
16 MILLION
1960
21 2/5 MILLION
A Gain of 5 Million Barrels Daily in Past 5 Years Likely to Be Repeated in Next 5 Years

Forecast of World Demand for Petroleum Products
(Barrels Daily)

	Forecast 1960	1955	1950	1946
United States	**10,325,000**	**8,415,000**	**6,507,000**	**4,912,000**
Outside U. S.	**11,150,000**	**7,653,000**	**4,468,600**	**2,865,900**
North America Outside U. S.	1,225,000	860,900	524,000	440,000
Caribbean Area	400,000	310,400	225,800	153,600
Other South American	925,000	696,500	469,200	223,600
Europe excluding U. S. S. R.	4,100,000	2,670,800	1,440,000	808,300
U. S. S. R.	2,000,000	1,368,000	770,000	514,700
Middle East	450,000	349,500	250,000	145,000
Far East and Oceania	1,475,000	971,000	513,500	420,700
Africa	575,000	425,900	276,100	160,000
World Total	**21,475,000**	**16,068,000**	**10,975,600**	**7,777,900**



Rest of World Soon to Be Consuming as Much Oil as the United States

ing the same time, U. S. demand is expected to rise by less than 2 million barrels, or one-fourth more than 1955 consumption.

Anticipated 1960 consumption outside of the U. S. is seen as being 2½ times greater than in 1950, and four times above 1946. In contrast, U. S. 1950 consumption is expected to be a little over one-half greater than in 1950, and more than double that of 1946.

Huge gain in motor vehicles. A very rapid increase in the adoption of the automobile, truck, bus, tractor and motorcycle in all parts of the world is the principal reason for the extremely large increase foreseen in oil consumption outside the U. S. Details on the increased use of motorized vehicles during recent years appears in the following article. In addition, the rest of the world is greatly expanding its industrial capacity and turning more and more to oil for heating purposes.

Increased population and industrial activity are factors that indicate greater future oil consumption in the U. S. The gigantic new $27 billion road building program which calls for the construction of over 40,000 miles of super-highways by 1970 will encourage additional use of automobiles, trucks and buses in the U. S. Large quantities of gasoline will be required to operate road construction machinery. However, relatively little impact of the highway program will be felt until after 1960.

Big European growth. Oil consumption of Europe (exclusive of U.S.S.R.) is seen as rising to more than 4 million barrels daily, 50 percent above the 2⅔ million used in 1955.

This region is turning to motorized vehicles and mechanized machinery in a big way. Consumption of oil almost doubled between 1946 and 1950, and again between 1950 and 1955.

Estimates on U.S.S.R. oil consumption indicate a sharp increase. Exact data are not available, and must be based on estimated production and exports. It is believed to have risen from ¾ million barrels in 1950 to over 1⅓ million in 1955. A similar increase would result in the consumption of 2 million barrels per day in 1960.

Sharp gain for Western Hemisphere. Oil demand outside the U. S. is rising rapidly in all parts of the Western Hemisphere. It can be expected to continue upward. The rate of growth may be faster than in the past.

Demand in North America (exclusive of the U. S.) rose from 524,000 barrels per day in 1950 to 860,900 barrels in 1955. Big gains occurred in Canada and Mexico. Anticipated 1960 consumption is 1¼ million barrels a day.

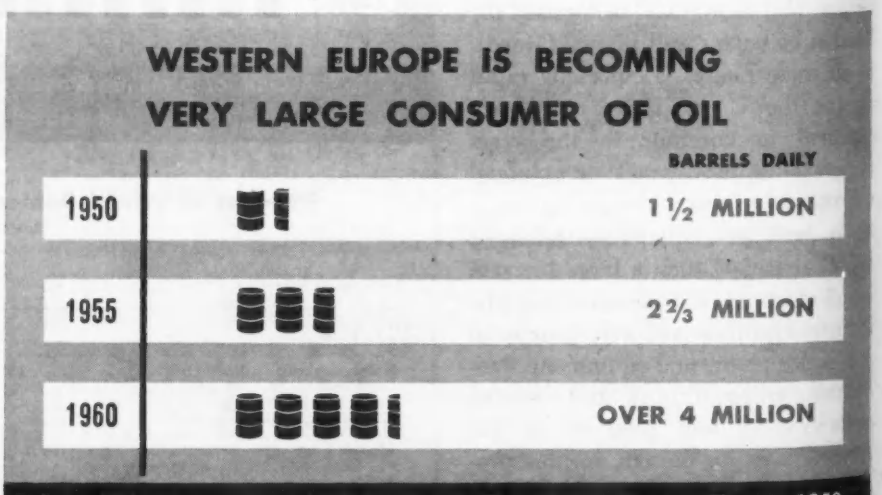
The Caribbean area now consumes 310,400 barrels daily, compared with 225,800 barrels in 1950. By 1960 demand should reach 400,000 barrels a day.

South America (exclusive of the Caribbean area) should be consuming almost 1 million barrels daily by 1960. Consumption in this area amounted to 696,500 barrels in 1955, in contrast with 469,200 barrels in 1950.

Fast growth in Far East. The Far East and Oceania also has increased oil consumption quite rapidly. Demand in 1955 was nearly 1 million barrels daily compared with 513,500 barrels in 1950. Consumption of almost 1½ million barrels per day seems probable by 1960.

Africa, too, is using more and more oil. Consumption totaled 425,900 barrels per day in 1955, up from 276,100 barrels in 1950. By 1960 Africa's oil demand should approximate 575,000 barrels daily.

The Middle East is likely to be using around 450,000 barrels per day by 1960. Consumption in 1955 was 349,500 barrels daily, compared with 250,000 barrels in 1950.



By 1960 Consumption Will Be Nearly Three Times Greater Than in 1950

World Is Becoming Highly Mechanized

Tremendous growth in motorized travel, mechanized farming and industrial operations outside of U. S. responsible for sharp oil consumption increase.

OIL CONSUMPTION has risen sharply in recent years because the world has turned to mechanized travel, farming and industrial operations at a faster pace than ever before. A huge increase in motor vehicles, motorcycles and farm tractors has taken place in recent years. Significantly, growth has been faster outside of the U. S. than in this country.

Expanded industrial activity and greater use of heating oils, both in the U. S. and elsewhere, are other factors responsible for enlarged oil consumption.

Prospects indicate further increases in the use of motorized vehicles. There are signs that the rate of growth is increasing, the past year showing one of the largest growths in history. Consequently, world demand for petroleum can be expected to rise higher and higher in the years ahead (see preceding article).

Particularly sharp growth is likely to occur outside the U. S. in coming years. These areas have a long way to go before they approach the U. S. But having realized the convenience and advantages of motorized transportation and farming, they can be expected to adopt them in large numbers.

The U. S. entered the mechanized era following World War I, the rest of the world reached this point following World War II. It is a significant period in world history, and also in petroleum industry history.

Twice as Many Cars. More than twice as many passenger cars were in operation at the beginning of 1956 than in 1947.

The world currently has over 72½ million passenger cars. This constitutes an increase of more than 38 million since January 1, 1947, when there were less than 34½ million.

Rate of growth shows no sign of slowing up. The past year recorded an increase of nearly 5½ million cars, one of history's largest gains.

The U. S. has nearly twice as many passenger cars today as in 1947. A remarkable growth in view of the large number operated in this country.

Growth has been much more rapid outside of the U. S. Three times more passenger cars are in operation outside of the U. S. than in 1947. There were less than 7 million at the beginning of 1947. Currently there are nearly 21 million.

Whereas the U. S. had almost 4 times more cars in 1947 than the rest of the world combined, it has only 2½ times more cars today despite its own large growth.

Big Trucks and Bus Growth. Nearly 2½ times more trucks and buses are operated in the world today than in 1947. A total of 22½ million trucks and buses existed on Jan. 1, 1956. At

TREMENDOUS GROWTH IN MOTOR VEHICLES THROUGHOUT WORLD

. . . Fastest Rate of Growth is Outside of U. S.

		MILLIONS OF UNITS IN OPERATION		
		JAN. 1, 1956	JAN. 1, 1947	INCREASE
PASSENGER CARS	WORLD—over twice as many as in 1947	72.6	34.4	38.2
	UNITED STATES—almost twice as many	51.6	27.5	24.1
	OUTSIDE U. S.—three times more	21.0	6.9	14.1
TRUCKS AND BUSES	WORLD—2¼ times more than in 1947	22.4	10.2	12.2
	UNITED STATES—nearly twice as many	10.2	5.7	4.5
	OUTSIDE U. S.—almost three times more	12.2	4.5	7.7
		JAN. 1, 1956	JAN. 1, 1953	INCREASE
MOTORCYCLES	WORLD—almost twice as many as in 1953	11.0	6.0	5.0
	UNITED STATES—about the same number	0.4	0.4	0.0
	OUTSIDE U. S.—nearly two times more	10.6	5.6	5.0
		JAN. 1, 1956	JAN. 1, 1951	INCREASE
FARM TRACTORS	WORLD—one-third more than in 1951	8.3	6.1	2.2
	UNITED STATES—only one-seventh more	4.3	3.8	0.5
	OUTSIDE U. S.—three-fourths more	4.0	2.3	1.7

WESTERN EUROPE HAS ADOPTED MOTORIZED VEHICLES IN BIG WAY

	MILLIONS OF UNITS IN OPERATION		
	JAN. 1, 1956	JAN. 1, 1947	INCREASE
PASSENGER CARS Nearly 3½ times more than in 1947	11.5	3.4	8.1
TRUCKS AND BUSES Almost 2⅗ times more than in 1947	4.3	1.7	2.6
	JAN. 1, 1956	JAN. 1, 1953	INCREASE
MOTORCYCLES Nearly two times more than in 1953	9.2	4.8	5.4
	JAN. 1, 1956	JAN. 1, 1951	INCREASE
FARM TRACTORS Over twice as many as in 1951	1.8	0.8	1.0

the start of 1947, there were only a little over 10 million.

Growth of trucks and buses has been greater outside of the U. S. than in the U. S. Significantly, more trucks and buses operate outside of the U. S. today, whereas the U. S. had more in 1947.

Motorcycles Popular Abroad. Motorcycle registrations have grown to 11 million, in contrast with less than 6 million just three years ago. Statistics are very incomplete beyond Jan. 1, 1953.

This type of transportation is very popular outside of the U. S. The U. S. has less than ½ million motorcycles, elsewhere there are 10-2/3 million.

More Farm Tractors Too. A big increase in number of farm tractors has taken place in recent years. There are 8-1/3 million farm tractors in the world today, compared with a little over 6 million five years ago.

Again growth has been greater outside the U. S. In 1951 there were only 2-1/3 million tractors outside of the U. S. Today there are 4 million.

World Motor Vehicle, Motorcycle and Tractor Registrations by Areas

COUNTRIES	PASSENGER CARS			TRUCKS AND BUSES			MOTORCYCLES			FARM TRACTORS		
	Jan. 1, 1956	Jan. 1, 1955	Jan. 1, 1947	Jan. 1, 1956	Jan. 1, 1955	Jan. 1, 1947	Jan. 1, 1956	Jan. 1, 1955	Jan. 1, 1953	Jan. 1, 1956	Jan. 1, 1955	Jan. 1, 1951
North America	55,107,832	51,379,034	28,901,387	11,531,650	11,083,733	6,231,699	520,000	466,462	480,256	4,858,278	4,741,054	4,168,000
Canada	2,900,000	2,682,639	1,220,620	931,000	881,875	367,175	35,000	37,661	43,000	430,000	425,000	368,000
Mexico	276,870	262,455	126,000	224,875	210,485	89,000	11,856	8,236	6,200	*70,000	68,000	*45,000
United States	51,631,216	48,174,447	27,496,096	10,253,486	9,875,683	5,737,879	450,000	400,116	410,839	4,344,106	4,234,212	3,800,000
Other North America	299,746	259,493	58,671	122,289	115,690	37,645	23,248	20,449	20,217	14,172	13,842	.....
Central America	69,742	57,578	19,685	27,542	29,381	30,762	7,274	6,525	3,831	1,610	1,559	*1,000
South America	1,102,001	1,059,252	445,655	831,480	833,423	293,785	80,836	74,597	62,962	102,164	90,738	*76,000
Argentina	311,769	314,185	204,535	163,428	163,408	81,075	27,693	26,659	18,000	54,556	47,497	.....
Brazil	*375,600	367,568	119,116	321,133	352,217	111,600	36,490	35,512	25,344	29,600	28,835	.....
Colombia	73,137	67,275	17,000	73,607	59,118	19,000	.....	.....	920	.....	.....	.....
Venezuela	140,268	119,825	18,172	94,060	86,239	22,275	9,244	7,809	4,163	4,600	4,600	.....
Other South America	201,227	190,399	86,832	179,252	172,441	59,835	7,409	4,617	7,535	13,408	*9,806	.....
Oceania	1,890,817	1,783,514	800,943	791,761	778,586	445,619	157,773	163,909	183,229	217,078	216,391	166,000
Australia	1,346,573	1,271,000	528,507	641,896	614,000	356,173	132,954	135,000	155,600	170,214	*165,000	132,000
New Zealand	373,817	353,384	214,913	110,492	128,013	72,485	20,702	24,723	23,752	46,108	51,120	34,000
Other Oceania	170,427	159,130	57,523	39,373	36,573	16,961	4,117	4,186	3,877	756	271	.....
Western (Free) Europe	11,538,727	10,268,939	3,376,992	4,326,228	4,055,446	1,673,349	9,221,850	8,641,604	4,833,235	1,764,413	1,629,706	851,000
Belgium	475,000	416,000	88,300	178,000	162,000	74,800	203,115	204,328	172,000	22,925	18,931	7,000
France	2,980,000	2,677,000	800,000	1,230,500	1,124,500	500,000	*1,750,000	1,700,000	825,000	*255,000	250,000	135,000
Western Germany	1,530,000	1,508,385	72,986	616,500	596,147	67,636	2,350,000	2,431,795	1,527,000	420,000	412,135	126,000
Great Britain	3,502,504	3,092,618	1,786,800	1,131,375	1,066,747	661,265	1,040,000	1,040,000	804,600	520,000	475,000	325,000
Italy	880,000	745,000	120,000	368,000	333,000	85,000	2,605,000	2,100,000	650,000	145,000	129,928	66,000
Other Free Europe	2,171,223	1,829,936	508,906	801,853	773,052	284,648	1,273,735	1,255,481	854,635	401,488	343,712	192,000
Eastern (Soviet) Europe	696,978	550,543	241,812	2,921,261	2,725,010	1,134,732	268,231	249,200	199,900	1,171,200	872,419	680,000
U. S. S. R.*	350,000	225,000	180,000	2,525,000	2,375,000	1,020,000	.....	.....	.....	1,000,000	750,000	560,000
Other Iron Curtain	346,978	*325,543	61,812	396,261	*350,010	114,732	268,231	249,200	199,900	171,200	122,419	120,000
Middle East	148,298	126,215	20,599	174,170	130,832	17,551	17,212	25,455	21,154	56,240	34,820	16,000
Far East	731,711	712,871	175,876	1,230,067	1,043,457	174,017	645,363	635,743	118,416	45,320	40,929	23,000
India	166,750	159,788	110,000	143,000	130,276	60,000	28,000	27,500	27,500	24,000	22,000	.....
Japan	147,376	134,816	14,942	721,114	633,231	53,000	484,705	485,807	28,779	*9,000	9,000	.....
Other Far East	417,585	418,267	25,334	365,953	279,950	29,017	132,658	122,436	62,139	12,320	9,929	.....
Africa	1,296,550	1,163,921	432,454	599,972	544,596	163,767	138,386	104,569	86,999	131,327	123,349	100,000
Algeria	95,000	86,600	27,870	50,663	48,000	21,813	34,190	22,000	17,100	22,545	18,500	.....
Egypt	71,700	69,858	28,771	23,800	20,907	8,545	12,000	10,740	10,510	12,300	12,300	.....
Morocco	109,958	92,958	6,850	49,515	44,955	3,800	14,144	13,144	8,300	6,000	6,000	.....
Rhodesia-Nyasaland	82,137	64,131	22,855	41,973	31,906	8,389	6,606	5,432	*5,000	9,245	8,253	.....
Union of South Africa	639,083	571,920	290,000	190,246	154,515	64,740	30,000	29,545	26,000	65,000	63,654	.....
Other Africa	298,672	*278,454	56,108	243,775	*244,313	56,480	41,446	23,708	20,089	16,237	14,642	.....
TOTAL WORLD	72,582,656	67,101,867	34,415,403	22,434,131	21,224,464	10,165,281	11,060,025	10,368,064	5,982,982	8,347,630	7,750,965	6,130,000
United States	51,631,216	48,174,447	27,496,096	10,253,486	9,875,683	5,737,879	450,000	400,116	410,839	4,344,106	4,234,212	3,800,000
Outside United States	20,951,440	18,927,420	6,919,307	12,180,645	11,348,781	4,427,402	10,610,125	9,967,948	5,572,143	4,003,524	3,516,753	2,330,000

* Indicates estimate. Source: "The American Automobile", except for 1951 tractor data which is from United Nations.

5.4 Percent Gain in U.S. Demand Indicated

Total demand for all oils expected to average 9,256,000 bpd in 1956.

THE U. S. THIS year is experiencing a growth in demand for petroleum that is somewhat above normal. The strong demand is based on the continuing high levels of business activity.

It now is indicated that total demand for all oils to be met by the U. S. petroleum industry in 1956 will average about 9,256,000 barrels daily. That would be an increase of 475,000 barrels daily or 5.4 percent over demand in 1955.

Domestic demand for all oils in 1956 is estimated by WORLD OIL at 8,920,000 barrels daily, an increase of 505,000 barrels or 6.0 percent over 1955. Exports are estimated at 336,000 barrels daily, a decrease of 30,000 barrels or 8.2 percent.

First Half. Total demand for all oils in the first half of 1956 averaged about 9,206,000 barrels daily. That was an increase of 510,000 barrels or 5.9 percent over the first half of 1955. Domestic demand for all oils averaged about 8,877,000 barrels daily. That was 541,000 barrels or 6.5 percent more than last year. Exports averaged about 329,000 barrels daily, down 31,000 a day or 8.6 percent.

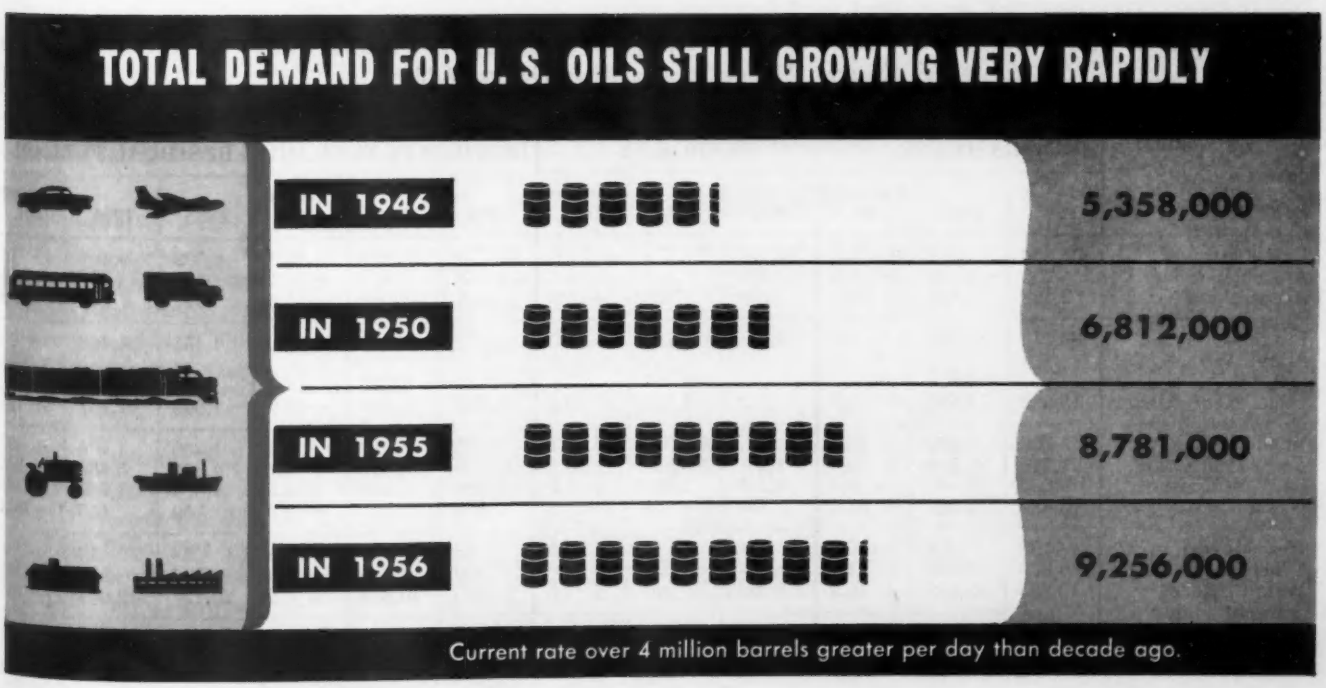
U. S. Crude Oil Stocks, by Grades, at Mid-Year, 1955 and 1956
From Bureau of Mines
(THOUSANDS OF BARRELS)

GRADE	July 2, 1955	June 30, 1956	Change
Pennsylvania Grade	**2,825**	**2,665**	**— 160**
Other Appalachian	**1,847**	**2,395**	**+ 548**
Lima-Michigan	**586**	**716**	**+ 130**
Illinois-Indiana	**11,165**	**10,970**	**— 195**
Arkansas	**2,775**	**2,937**	**+ 162**
Kansas	**7,781**	**8,938**	**+1,157**
Nebraska-N. Dakota	**1,866**	**2,340**	**+ 474**
Louisiana	**15,998**	**15,440**	**— 558**
North Louisiana	2,902	2,490	— 412
Gulf Louisiana	13,096	12,950	— 146
Mississippi	**3,002**	**2,878**	**— 124**
New Mexico	**8,538**	**7,284**	**—1,254**
Oklahoma	**23,112**	**25,922**	**+2,810**
Texas	**128,902**	**123,056**	**—5,846**
E. Texas Proper	9,772	9,311	— 461
West Texas	57,602	60,093	+2,491
Gulf Coast	25,728	21,518	—4,210
Other Texas	35,800	32,134	—3,666
Panhandle	3,542	3,206	— 336
North Texas	9,224	9,051	— 173
South Texas	6,460	4,957	—1,503
Rest of State	16,574	14,920	—1,654
Wyoming	**15,788**	**19,013**	**+3,225**
Other Rocky Mt.	**5,680**	**7,187**	**+1,507**
California	**31,876**	**28,523**	**—3,353**
Total Domestic	**261,741**	**260,264**	**—1,477**
Foreign	**11,570**	**14,413**	**+2,843**
In California	2,445	3,540	+1,095
Other Foreign	9,125	10,873	+1,748
Total In U.S.	**273,311**	**274,677**	**+1,366**
Total located in PAW			
Dist. 1	**21,127**	**18,856**	**—2,271**
Dist. 2	**81,892**	**94,041**	**+12,149**

Second Half. Total demand for all oils in the latter half of 1956 will average about 9,305,000 barrels daily, it is estimated. This would be 441,000 barrels or 5.0 percent more than demand in the second half of 1955. Domestic demand for all oils is estimated at 8,963,000 barrels daily. That would be 469,000 barrels or 5.5 percent above latter half of 1955. Exports are estimated at 342,000 barrels daily. That would be 28,000 barrels or 7.6 percent less than last year.

Third Quarter. In the third quarter of 1956, total demand for all oils is estimated at 8,675,000 barrels daily. That is an increase of 409,000 barrels or 4.9 percent over third quarter demand in 1955.

Fourth Quarter. Consumption of petroleum will reach its peak for 1956



in the fourth quarter, as cold weather boosts the use of oil for heating. Total demand for all oils will average 9,935,000 barrels daily, it is here estimated. That would be an increase of 473,000 barrels or 5.0 percent over 1955.

Supply To Be Increased. To meet the record breaking demand for petroleum products this year, supplies of oils from all sources have been increased and will be further drawn upon at high rates. Imports of crude have been stepped up sharply, although product imports have been at about the same levels as last year. Production of natural gas liquids in the first half of this year was about 10 percent above last year. Domestic production of crude oil has been running and probably will continue to run around 6 percent above last year.

Stocks. Supply and demand have been kept fairly well balanced. However, since the middle of this year, there has been a growing threat of oversupply. Both imports and domestic production are higher than desirable. The high imports and crude production threatened to result in excessive crude runs to stills and accumulation of surplus stocks of products.

Gasoline stocks were greater than indicated requirements. Prevailing yields of gasoline from crude at refineries were relatively large, and yields of distillate fuel oil were relatively low. It was feared that in order to produce enough heating oil, runs to stills might be stepped up to levels that would result in seriously excessive production and stocks of gasoline.

Stocks of crude oil at mid-year 1956 were at about the same levels as at the middle of 1955 and were considered satisfactory.

U. S. Crude Runs to Stills and Refining Capacity, by Districts

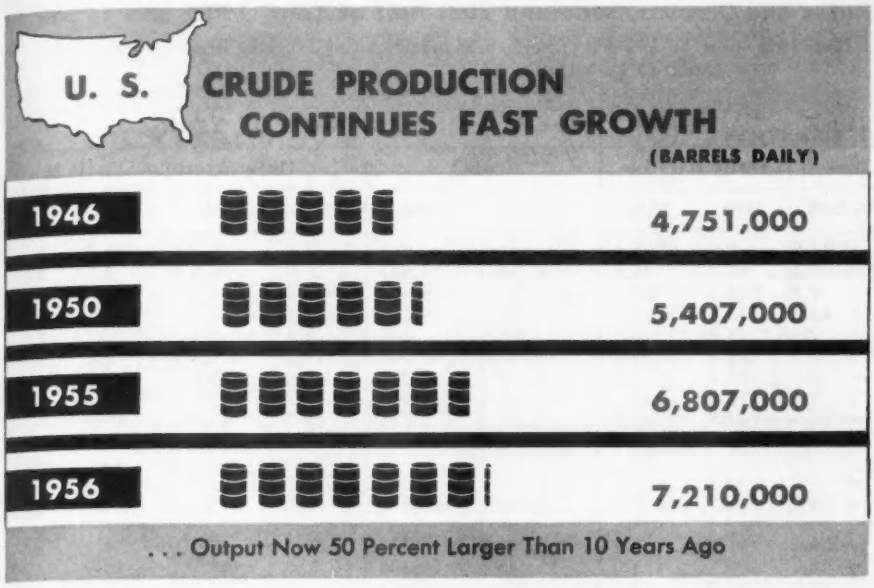
Data from Bureau of Mines, except May and June, 1956, and refining capacities from A.P.I.
(THOUSANDS OF BARRELS)

DISTRICT	DAILY CAPACITY AND RUNS IN JUNE								CRUDE RUN IN FIRST 6 MONTHS				
	Capacity			Runs			% Operated		Total		Daily		
	1955	1956	% Dif.	1955	1956	% Dif.	1955	1956	1955	1956	1955	1956	% Dif.
East Coast	1,195	1,169	— 2.2	1,025.9	1,145.8	+11.7	85.8	98.0	189,654	200,376	1,047.8	1,101.0	+ 5.1
Appalachian No. 1	111	108	— 2.7	91.4	108.8	+19.0	82.3	100.7	17,322	17,965	95.7	98.7	+ 3.1
Appalachian No. 2	95	95	.....	99.8	94.1	— 5.7	105.1	99.1	16,820	18,766	92.9	103.1	+11.0
Ind., Ill., Ky.	1,525	1,505	— 1.3	1,403.7	1,355.1	— 3.5	92.0	90.0	244,933	253,963	1,353.2	1,395.4	+ 3.1
Minn., Wis., N.D., S.D.	.....	99	.....	.....	91.7	.....	.....	92.6	.....	14,288	.....	78.5	.....
Okla., Kans., Mo.	737	733	— 0.5	704.0	719.2	+ 2.2	95.5	98.1	118,392	125,101	654.1	687.4	+ 5.1
Texas Inland	289	303	+ 4.8	246.9	281.4	+14.0	85.4	92.9	45,797	49,326	253.0	271.0	+ 7.1
Texas Gulf Coast	1.937	2.003	+ 3.4	1,811.5	2,026.1	+11.8	93.5	101.2	330,916	361,869	1,828.3	1,988.3	+ 8.7
La. Gulf Coast	687	690	+ 0.4	675.0	744.6	+10.3	98.2	107.9	116,157	128,227	641.8	704.5	+ 9.8
N. La., Ark.	99	99	.....	95.0	95.3	+ 0.3	96.0	96.3	16,220	15,249	89.6	83.8	— 6.5
New Mexico	23	26	+13.0	22.7	23.0	+ 1.3	98.7	88.5	3,745	4,003	20.7	22.0	+ 6.3
Other Rocky Mtn.	282	297	+ 5.3	267.5	283.9	+ 6.1	94.9	95.6	45,023	48,236	248.7	265.0	+ 6.6
West Coast	1,356	1,346	— 0.7	1,040.2	1,079.0	+ 3.7	76.7	80.2	188,006	200,402	1,038.7	1,101.1	+ 6.0
Total U.S.	8,366	8,474	+ 1.3	7,483.7	8,048.0	+ 7.5	89.4	95.0	1,332,985	1,437,771	7,364.5	7,899.8	+ 7.3

U. S. Stocks of Major Refined Products at Mid-Year (End of June), 1955 and 1956, by Refining Districts

(Sources: 1955 from Bureau of Mines; 1956 from A.P.I.)
(THOUSANDS OF BARRELS)

DISTRICT	GASOLINE			KEROSINE			DISTILLATE FUEL OIL			RESIDUAL FUEL OIL		
	1955	1956	Percent Dif.	1955	1956	Percent Dif.	1955	1956	Percent Dif.	1955	1956	Percent Dif.
East Coast	35,666	41,012	+ 15.0	11,802	10,279	—12.9	32,718	28,479	—13.0	9,592	9,406	— 1.9
Appalachian No. 1	4,206	4,423	+ 5.2	524	471	—10.1	2,058	1,767	—14.1	354	336	— 5.1
Appalachian No. 2	2,428	2,823	+ 16.3	538	629	+16.9	815	769	— 5.6	377	242	— 35.8
Ind., Ill., Ky.	33,073	32,969	— 0.3	6,911	4,766	—31.0	19,077	13,545	—29.0	4,451	4,402	— 1.1
Minn., Wis., N. D., S. D.	.....	6,672	.....	.....	767	.....	.....	4,706	.....	.....	288	.....
Okla., Kans. Mo.	15,086	15,893	+ 5.3	1,721	1,369	—20.5	11,232	9,666	—13.9	1,045	1,251	+ 19.7
Inland Texas	5,758	6,621	+ 15.0	377	385	+ 2.1	1,875	1,710	— 8.8	1,250	1,404	+ 12.3
Texas Gulf Coast	21,145	24,703	+ 16.8	4,240	3,816	—10.0	12,680	13,531	+ 6.7	4,651	5,685	+ 22.2
La. Gulf Coast	9,636	10,448	+ 8.4	2,149	2,396	+11.5	5,886	6,090	+ 3.5	1,674	1,762	+ 5.3
N. La., Ark.	3,489	4,291	+ 23.0	866	435	—49.8	1,804	1,751	— 2.9	59	166	+181.4
New Mexico	188	406	+116.0	10	5	—50.0	53	105	+98.1	24	12	— 50.0
Other Rocky Mt.	6,879	6,946	+ 1.0	307	350	+14.0	2,309	2,635	+14.1	794	878	+ 10.6
West Coast	19,885	23,522	+ 18.3	385	391	+ 1.6	10,145	10,239	+ 0.9	20,127	12,944	— 35.7
Total U.S.	157,439	180,729	+ 14.8	29,830	26,059	—12.6	100,652	94,993	— 5.6	44,398	38,776	— 12.7



U. S. Crude Production . . . to average approximately 7,210,100 barrels daily in 1956.

PRODUCTION OF CRUDE oil in the U. S. will average approximately 7,210,100 barrels daily for 1956, WORLD OIL estimates. This would be an increase of 403,200 barrels daily or 5.9 percent over the 6,806,900 barrels daily produced in 1955.

The increase in production this year is based on a similar expansion in demand for petroleum products. (Total demand for all oils, domestic and export, is expected to show an increase of about 5.4 percent in 1956 over 1955, on daily average basis.)

In the first half of 1956, U. S. crude oil production averaged 7,155,600 barrels per day. That was an increase of 379,800 barrels or 5.6 percent over the output of 6,775,800 barrels daily in the first six months of 1955.

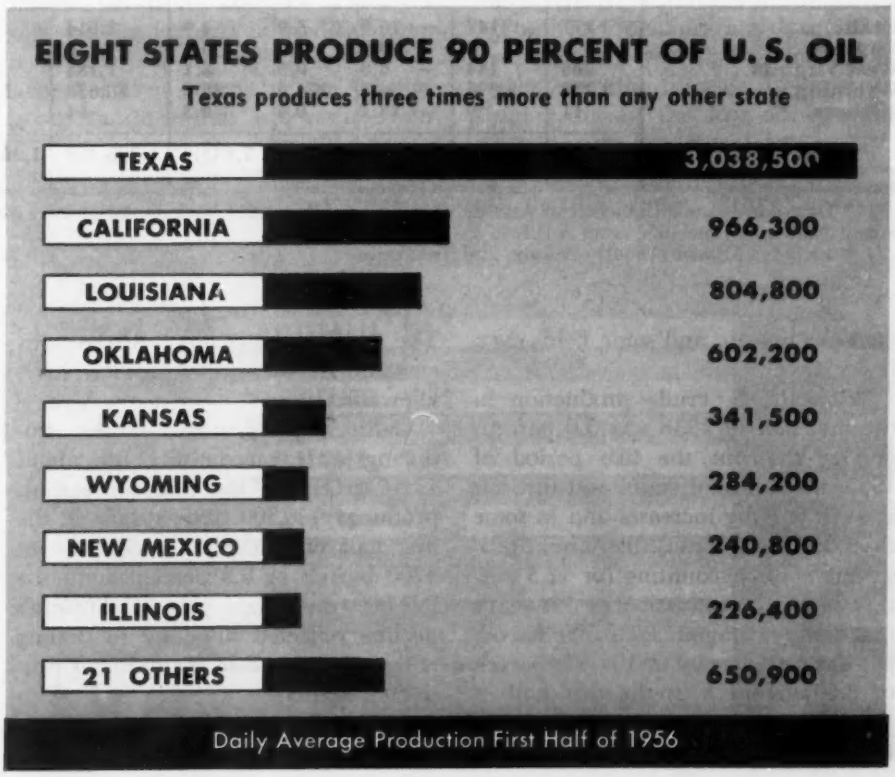
For the latter half of 1956, crude production in the U. S. will average about 7,264,000 barrels per day, WORLD OIL forecasts. This would be an increase of 426,500 barrels daily or 6.2 percent over the production in the second half of 1955.

In the third quarter of 1956, July through September, U. S. crude production is expected to average about 7,090,100 barrels per day, an increase of 414,900 barrels or 6.2 percent over output in the third quarter of 1955. This is a fairly firm estimate, as it includes known trends in July and August.

For the fourth quarter of 1956, production of crude oil in the U. S. is here estimated at 7,438,000 barrels daily. That would be an increase of 438,200 barrels or 6.3 percent over the output in the final quarter of 1955. The high production for the last quarter will reflect the heavy seasonal demand for crude in supplying requirements of fuel oils.

The above estimates of U. S. crude production for the latter half of 1956 are based on prospects that the total domestic and export demand for petroleum will average about 9,305,000 barrels daily, an increase of 441,000 barrels daily or 5 percent over the latter half of 1955. Allowances were made for a seasonal build-up of product stocks in the third quarter; seasonal withdrawals of products from storage in the fourth quarter; production of about 750,000 barrels per day of natural gas liquids in the third quarter and about 800,000 daily in the fourth quarter; no material change in crude stocks in the third or fourth quarters; and the currently indicated rates of imports of crude and products in the latter half of the year.

Actual rates of U. S. crude production in coming months may be affected by trends of imports. There has been much agitation among independent operators demanding a holding down of U. S. petroleum imports. The federal government will hold hearings in October to consider proposals that imports be restricted. Pressure on importing companies has been increasing. Any slowing down of imports would help to relieve the severity of restrictions on domestic crude production. Under the strict allowables, in recent months, Texas fields generally have been producing only 15 or 16



U. S. Crude Oil Production, by States and Districts, June and First Half of Year, 1955 and 1956

From U. S. Bureau of Mines except May and June, 1956, from A.P.I. weekly reports, and breakdown of Texas by Districts from A.P.I.

(THOUSANDS OF BARRELS)

State or District	JUNE Total 1955	JUNE Total 1956	JUNE % Diff.	JUNE Daily Average 1955	JUNE Daily Average 1956	FIRST HALF OF YEAR Total 1955	FIRST HALF OF YEAR Total 1956	FIRST HALF OF YEAR Daily Average 1955	FIRST HALF OF YEAR Daily Average 1956	FIRST HALF OF YEAR % Diff.	% of U.S. in 1956
Alabama	**116**	**167**	**+ 44.0**	**3.9**	**5.6**	**659**	**988**	**3.6**	**5.4**	**+ 50.0**	**0.1**
Arkansas	**2,321**	**2,265**	**— 2.4**	**77.3**	**75.5**	**14,236**	**13,903**	**78.6**	**76.4**	**— 2.8**	**1.1**
California	**29,246**	**28,868**	**— 1.3**	**974.9**	**962.2**	**175,744**	**175,860**	**971.0**	**966.3**	**— 0.5**	**13.5**
Colorado	**4,300**	**4,978**	**+ 15.8**	**143.4**	**165.9**	**23,373**	**29,630**	**129.1**	**162.8**	**+ 26.1**	**2.3**
Florida	**39**	**40**	**+ 2.6**	**1.3**	**1.3**	**235**	**248**	**1.3**	**1.4**	**+ 7.7**	**0.0**
Illinois	**6,983**	**6,839**	**— 2.1**	**232.8**	**228.0**	**39,772**	**41,203**	**219.7**	**226.4**	**+ 3.1**	**3.2**
Indiana	**972**	**945**	**— 2.8**	**32.4**	**31.5**	**5,407**	**5,291**	**29.9**	**29.1**	**— 2.7**	**0.4**
Kansas	**9,620**	**10,294**	**+ 7.0**	**320.6**	**343.1**	**60,120**	**62,148**	**332.2**	**341.5**	**+ 2.8**	**4.8**
Kentucky	**1,284**	**1,434**	**+ 11.7**	**42.8**	**47.8**	**7,268**	**8,725**	**40.2**	**47.9**	**+ 19.1**	**0.7**
Louisiana	**21,011**	**23,637**	**+ 12.5**	**700.4**	**787.9**	**129,842**	**146,471**	**717.3**	**804.8**	**+ 12.2**	**11.2**
North Louisana	3,549	3,735	+ 5.2	118.3	124.5	21,420	22,900	118.3	125.8	+ 6.3	1.7
South Louisana	17,462	19,902	+ 14.0	582.1	663.4	108,422	123,571	599.0	679.0	+ 13.3	9.5
Michigan	**940**	**882**	**— 6.2**	**31.3**	**29.4**	**5,707**	**5,499**	**31.5**	**30.2**	**— 4.1**	**0.4**
Mississippi	**3,023**	**3,330**	**+ 10.2**	**100.7**	**111.0**	**17,458**	**20,206**	**96.5**	**111.0**	**+ 15.0**	**1.5**
Montana	**1,312**	**1,863**	**+ 42.0**	**43.7**	**62.1**	**7,919**	**10,459**	**43.8**	**57.5**	**+ 31.3**	**0.8**
Nebraska	**819**	**1,155**	**+ 41.0**	**27.3**	**38.5**	**4,343**	**7,311**	**24.0**	**40.2**	**+ 67.5**	**0.5**
Nevada	**6**	**6**	.....	**0.2**	**0.2**	**35**	**38**	**0.2**	**0.2**	.....	**0.0**
New Mexico	**6,662**	**7,161**	**+ 7.5**	**222.1**	**238.7**	**40,068**	**43,831**	**221.4**	**240.8**	**+ 8.8**	**3.3**
Southeast New Mexico	6,577	7,113	+ 8.1	219.3	237.1	39,552	43,336	218.5	238.1	+ 9.0	3.3
Northwest N. Mexico	85	48	— 43.5	2.8	1.6	516	495	2.9	2.7	— 6.9	0.0
New York	**245**	**321**	**+ 31.0**	**8.2**	**10.7**	**1,461**	**1,542**	**8.1**	**8.5**	**+ 4.9**	**0.1**
North Dakota	**860**	**986**	**+ 14.6**	**28.7**	**32.9**	**4,915**	**6,393**	**27.2**	**35.1**	**+ 29.0**	**0.5**
Ohio	**376**	**377**	**+ 0.3**	**12.5**	**12.6**	**2,061**	**2,285**	**11.4**	**12.5**	**+ 9.6**	**0.2**
Oklahoma	**16,659**	**17,564**	**+ 5.4**	**555.3**	**585.5**	**99,328**	**109,601**	**548.8**	**602.2**	**+ 9.7**	**8.4**
Pennsylvania	**753**	**615**	**— 18.3**	**25.1**	**20.5**	**4,137**	**3,868**	**22.9**	**21.2**	**— 7.4**	**0.3**
***Texas**	**82,209**	**88,698**	**+ 7.9**	**2,740.3**	**2,956.6**	**531,224**	**553,008**	**2,934.9**	**3,038.5**	**+ 3.5**	**42.5**
Dist. 1: South Central	1,605	1,635	+ 1.9	53.5	54.5	9,347	9,742	51.6	53.5	+ 3.7	0.7
Dist. 2: Middle Gulf	4,312	4,585	+ 6.3	143.7	152.8	27,863	28,870	153.9	158.6	+ 3.1	2.2
Dist. 3: Upper Gulf	13,285	13,518	+ 1.7	442.9	450.6	83,921	82,773	463.7	454.8	— 1.9	6.4
Dist. 4: L. Gulf-S.W.	7,068	7,099	+ 0.4	235.6	236.6	45,291	44,812	250.2	246.2	— 1.6	3.4
Dist. 5: East Central	1,374	1,332	— 3.1	45.8	44.4	8,695	8,379	48.0	46.0	— 4.2	0.6
Dist. 6: Northeast	9,842	9,885	+ 0.4	328.0	329.5	64,234	63,243	354.9	347.5	— 2.1	4.9
Dist. 7-B: N. Central	4,228	4,593	+ 8.6	140.9	153.1	25,498	28,367	140.9	155.9	+ 10.6	2.2
Dist. 7-C: W. Central	5,533	5,629	+ 1.4	184.4	187.6	34,395	33,612	190.0	184.7	— 2.8	2.6
Dist. 8: West	27,245	31,083	+ 14.1	908.2	1,036.1	171,896	189,722	949.7	1,042.4	+ 9.8	14.6
Dist. 9: North	6,153	6,484	+ 5.4	205.1	216.1	36,183	38,089	199.9	209.3	+ 4.7	2.9
Dist. 10: Panhandle	2,656	2,855	+ 7.5	88.6	95.2	15,751	17,104	87.0	94.0	+ 8.0	1.3
Utah	**177**	**147**	**— 16.9**	**5.9**	**4.9**	**1,014**	**941**	**5.6**	**5.2**	**— 7.1**	**0.1**
Virginia	**1**	**3**	**+200.0**	**0.0**	**0.1**	**6**	**9**	**0.0**	**0.0**	.....	**0.0**
West Virginia	**206**	**184**	**— 6.8**	**6.9**	**6.1**	**1,184**	**1,087**	**6.5**	**6.0**	**— 7.7**	**0.1**
Wyoming	**8,238**	**8,595**	**+ 4.3**	**274.6**	**286.5**	**48,838**	**51,728**	**269.8**	**284.2**	**+ 5.3**	**4.0**
†Others	**11**	**9**	**— 18.2**	**0.4**	**0.3**	**64**	**52**	**0.3**	**0.3**	.....	**0.0**
Total U. S.	**198,389**	**211,363**	**+ 6.5**	**6,613.0**	**7,045.4**	**1,226,418**	**1,302,325**	**6,775.8**	**7,155.6**	**+ 5.6**	**100.0**

* Data for Texas in first half of year by districts are from A.P.I. and do not agree with Texas total, which is from Bureau of Mines except May and June 1956 from A.P.I.

† Includes Missouri, South Dakota, and Tennessee.

days per month, and some fields even fewer days.

While U. S. crude production in the first half of 1956 was 5.6 percent greater than in the like period of 1955, the different states and districts showed varying increases and in some cases decreases. Texas, the largest producing state, accounting for 42.5 percent of U. S. production in this year's first half, averaged 3,038,500 barrels per day, an increase of 103,600 barrels or 3.5 percent over the first half of 1955. This gain was less than the national average, on a percentage basis. The small increase reflected the tight curtailment of output under strict allowables.

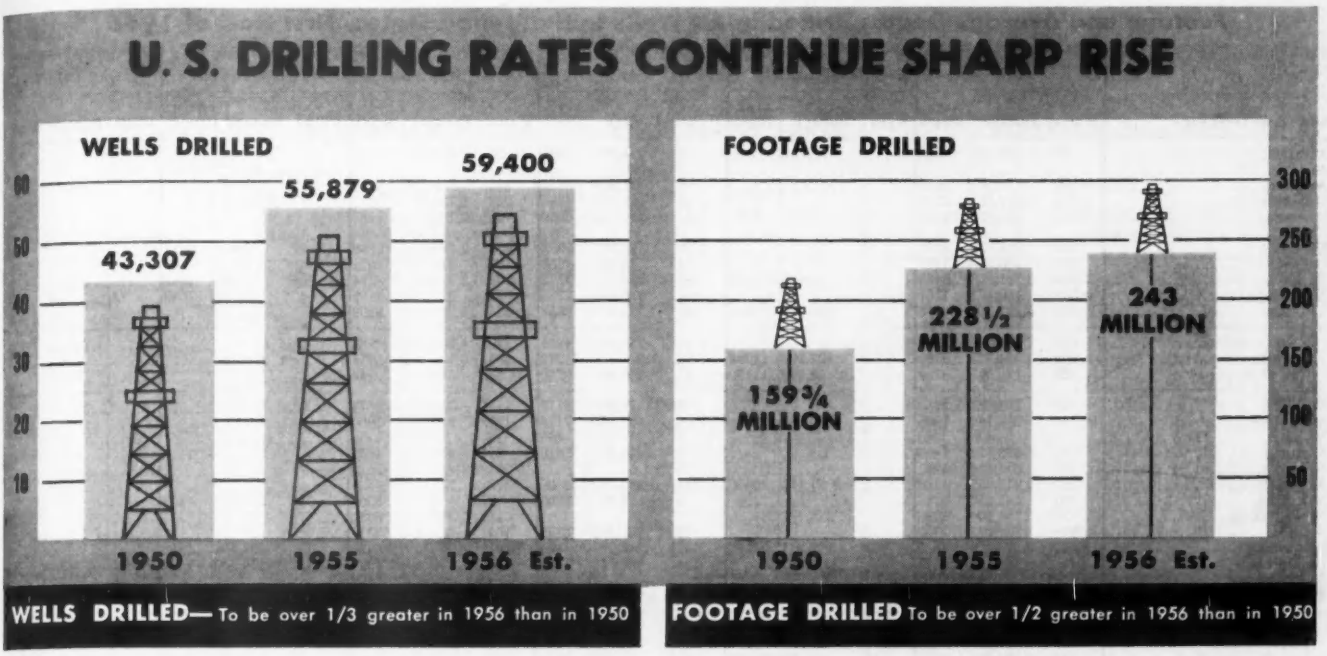
California, the second largest producing state, accounting for about 13.5 percent of the nation's output, produced 966,300 barrels daily in the first half of this year, a decrease of 4700 barrels or 0.5 percent from the 971,000 daily last year. California's decline reflected difficulty in finding new reserves and in maintaining producing ability.

Louisiana is the No. 3 oil producing state, with over 11 percent of the nation's total. It averaged 804,800 barrels daily in the initial half of 1956, up 87,500 barrels or 12.2 percent over the like period of 1955.

Oklahoma, No. 4 state, averaged 602,200 barrels daily, 8.4 percent of the U. S. total, and an increase of 53,400 barrels or 9.7 percent over the first half of last year.

Kansas produced 341,500 barrels daily in this year's first half, up 9300 barrels or 2.8 percent over last year.

New Mexico averaged 240,800 barrels daily, an increase of 19,400 barrels or 8.8 percent.



Another Big Gain in U. S. Drilling

Drilling of 59,400 new wells and 243 million feet of hole forecast in 1956 by WORLD OIL's midyear survey . . . 3521 wells and 14.5 million feet above the record rate of last year.

By **WARREN L. BAKER,** Editorial Director,
and **CECIL W. SMITH,** Statistical Editor, World Oil

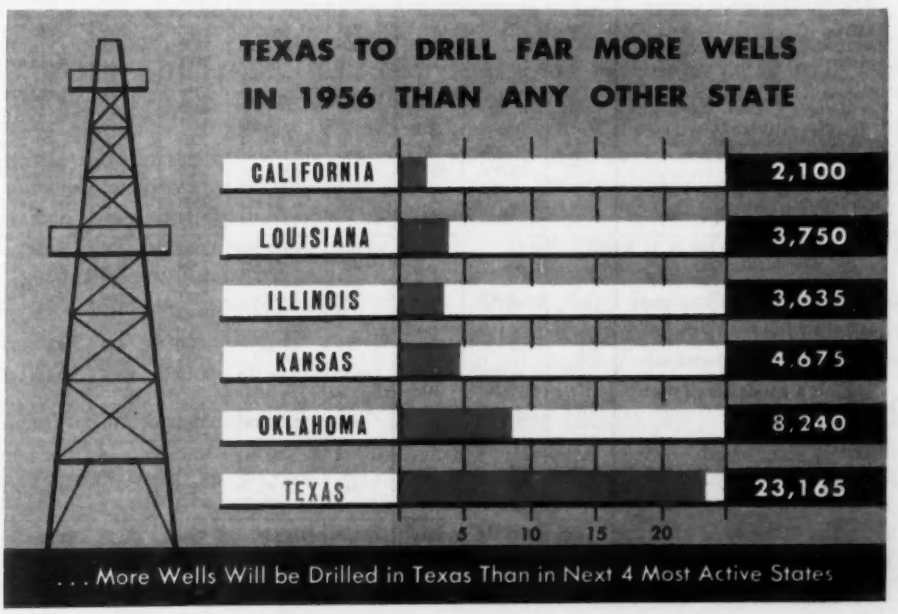
Another very large increase in U. S. drilling activity is seen for 1956, despite the retarding influence of the steel strike. A mid-year study of prospects, prompts World Oil to forecast that 59,400 new wells and almost 243 million feet of hole will be drilled in the U. S. in 1956.

This would be 6.3 percent of 3521 more wells and nearly 14½ million more feet of hole than drilled in 1955. In contrast with 1954, the revised 1956 forecast represents the drilling of 7497 more wells and 33½ million more footage. It calls for 16,093 more wells and 83¼ million more feet of hole than drilled in 1950.

The revised forecast anticipates completion of the largest volume of wells and footage of any six months period in history. A total of 30,506 wells and 125½ million feet of hole must be drilled during the last half of 1956 to fulfill this forecast. This would compare with the drilling of 29,810 wells and 122⅓ million feet of hole during the last half of 1955, which exceeds all other six months periods.

Based on many factors. This record drilling forecast is predicated on a number of factors. Some allowance has been made for the tubular goods shortage that will result from the steel strike, but that this will not be too severe a blow to drilling operations.

The heavy drilling rate during the first half of the year had a very strong influence on the forecast. U. S. completions during the first six months



Footage and Average Depths Drilled in All Wells in the United States, First Half of 1956

STATE or DISTRICT	OIL			DISTILLATE			GAS			DRY			WATER INPUT			GAS INPUT		
	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth	Wells	Footage	Avge. Depth
Alabama	22	218,301	9923				1	4,998	4998	23	132,655	5768						
Arizona																		
Arkansas	246	718,289	2920				6	31,039	5173	155	536,474	3461						
California	810	3,692,717	4559				25	122,050	4882	226	1,133,877	5017						
Colorado	153	832,517	5441	1	5,920	5920	54	284,522	5269	443	2,298,143	5188						
Florida										6	35,002	5834						
Illinois	805	1,981,379	2461				20	21,762	1088	958	2,184,288	2280	1	2,087	2087			
Indiana	107	200,239	1871				4	3,830	958	188	314,117	1671	4	6,212	1553			
Kansas	1,098	3,741,583	3408	1	4,828	4828	182	686,579	3772	1,034	3,788,653	3664	21	21,000	1000			
Kentucky	355	410,772	1157				103	229,132	2225	382	571,178	1495	5	7,741	1548	1	1,174	1174
Louisiana	923	5,885,362	6376	67	803,590	11994	155	1,373,076	8859	634	5,268,088	8309						
North Louisiana	423	1,200,697	2839				58	281,958	4861	229	1,091,986	4768						
South Louisiana	500	4,684,665	9369	67	803,590	11994	97	1,091,118	11249	405	4,176,102	10311						
†Gulf of Mexico	129	1,126,007	8729	4	44,479	11120	17	166,410	9789	66	643,053	9743						
Michigan	113	332,477	2942				5	18,886	3777	117	312,839	2674						
Mississippi	65	509,146	7833	7	60,085	8584	8	57,244	7156	130	910,778	7006						
Missouri	1	400	400				1	450	450	15	17,245	1150						
Montana	104	612,172	5886				4	10,438	2610	87	378,588	4352						
Nebraska	176	1,038,624	5901							336	1,889,868	5625						
New Mexico	457	2,278,662	4986	2	21,179	10590	318	1,242,642	3908	170	770,927	4535						
New York	120	165,250	1377				1	3,200	3200	1	3,500	3500	75	105,250	1403			
North Dakota	91	754,200	8288							48	319,281	6652						
Ohio	278	751,025	2702				72	169,572	2355	159	368,405	2317						
Oklahoma	2,544	9,277,459	3647	42	226,311	5388	187	830,997	4444	1,241	4,256,627	3430	45	103,788	2306			
Pennsylvania	113	183,186	1621				126	560,743	4450	36	179,937	4998	111	179,200	1614	6	4,200	700
South Dakota										4	28,436	7109						
Texas	6,639	26,843,532	4043	153	1,341,889	8771	377	2,054,901	5451	4,025	16,964,176	4215	90	194,233	2158	1	1,244	1244
Dist. 1: South Central	669	1,652,948	2471	1	10,517	10517	12	81,175	6765	367	1,093,115	2978						
Dist. 2: Middle Gulf	142	885,623	6237	37	302,311	8171	51	271,066	5315	197	1,198,683	6085						
Dist. 3: Upper Gulf	449	2,696,458	6005	42	425,231	10125	45	335,895	7464	356	2,471,062	6941	1	6,202	6202			
Dist. 4: Lower Gulf-S.W.	285	1,307,092	4586	64	513,141	8018	68	349,018	5133	320	1,717,602	5368						
†Gulf of Mexico	1	8,916	8916	1	10,855	10855	2	19,824	9912	6	61,216	10203						
Dist. 5 & 6 East Central and Northeast	232	1,104,076	4759	3	29,531	9844	46	314,730	6842	290	1,318,030	4545						
Dist. 7-B & 9 North Central and North	2,273	7,343,940	3231				35	200,754	5736	1,890	5,858,783	3100	81	167,850	2072			
Dist. 7-C & 8 West Central and West	2,009	10,213,508	5084	3	35,237	11746	18	63,266	3515	532	2,845,713	5349	8	20,181	2523			
Dist. 10: Panhandle	490	1,639,887	3347	3	25,921	8640	102	400,108	3923	73	461,188	6318						
Utah*	12	70,112	5843				11	52,623	4784	49	215,906	4406						
West Virginia	33	69,647	2111				258	688,636	2669	59	163,667	2774						
Wyoming	241	1,108,134	4598				19	88,617	4664	184	883,387	4801						
Other States*										9	62,472	6941						
Total United States	15,506	61,675,185	3978	273	2,463,802	9025	1,937	8,535,937	4407	10,719	43,988,514	4104	352	619,511	1760	8	6,618	827

STATE or DISTRICT	SALT WATER DISPOSAL			TOTAL NEW WELLS								WILDCAT WELLS		
				First Half 1956			First Half 1955			Forecast Second Half 1956		Drilled First Half 1956	Drilled First Half 1955	Forecast Second Half 1956
	Wells	Footage	Average Depth	Wells	Footage	Average Depth	Wells	Footage	Average Depth	Wells	Footage			
Alabama				46	355,954	7738	28	119,305	4261	49	214,046	15	28	30
Arizona							4	16,136	4034	3	14,000		4	2
Arkansas				407	1,285,802	3159	331	1,079,804	3262	503	1,626,198	61	62	99
California				1,061	4,948,644	4664	1,215	5,931,216	4741	1,039	5,131,356	118	144	157
Colorado				651	3,421,102	5255	716	3,857,283	5387	674	3,733,898	289	356	411
Florida				6	35,002	5834	17	106,664	6274	6	34,998	6	16	6
Illinois	2	4,604	2302	1,786	4,194,120	2348	1,700	4,104,932	2415	1,849	4,322,880	453	291	447
Indiana				303	524,398	1731	291	439,830	1511	352	609,602	79	78	121
Kansas	27	97,469	3610	2,363	8,340,112	3529	2,280	8,329,597	3653	2,312	9,190,888	504	436	716
Kentucky				846	1,219,997	1442	717	1,184,570	1652	994	1,433,003	68	53	87
Louisiana	1	9,900	9900	1,780	13,340,016	7494	2,019	12,691,696	6286	1,970	14,575,984	252	211	348
North Louisiana				710	2,574,641	3626	1,043	3,041,556	2916	815	2,955,359	89	77	101
South Louisiana	1	9,900	9900	1,070	10,765,375	10061	976	9,650,140	9887	1,155	11,620,625	163	134	247
†Gulf of Mexico				217	1,979,949	9124	155	1,434,879	9257	308	2,810,051	32	32	53
Michigan				235	664,202	2826	250	742,252	2969	245	691,798	72	98	78
Mississippi				210	1,537,253	7320	243	1,812,731	7460	215	1,573,747	77	88	98
Missouri				17	18,095	1064	24	13,095	546	8	4,905	11	17	4
Montana				195	1,001,198	5134	138	711,688	5157	265	1,360,802	57	41	83
Nebraska				512	2,928,492	5720	363	2,083,776	5740	588	3,363,508	227	144	313
New Mexico				947	4,313,410	4555	811	3,451,498	4256	1,058	4,819,590	93	75	157
New York				197	277,200	1407	163	225,255	1382	203	322,800			10
North Dakota				139	1,073,481	7723	115	840,228	7306	151	1,088,519	32	21	53
Ohio				509	1,289,002	2532	533	1,122,419	2106	666	1,295,998	3	13	17
Oklahoma	61	138,561	2271	4,120	14,833,743	3600	3,607	12,268,185	3401	4,120	14,830,257	357	291	493
Pennsylvania				392	1,107,266	2825	352	672,233	1910	433	1,223,734		2	15
South Dakota				4	28,436	7109	6	35,579	5930	11	46,564	4	6	11
Texas	8	15,906	1988	11,293	47,415,881	4199	9,460	41,554,181	4393	11,872	50,373,119	2,371	2,013	3,109
Dist. 1: South Central				1,049	2,837,755	2705	880	2,336,132	2655	1,056	2,856,245	241	206	279
Dist. 2: Middle Gulf				427	2,657,683	6224	394	2,366,395	6006	523	3,255,317	124	116	196
Dist. 3: Upper Gulf				893	5,934,848	6646	874	5,610,789	6420	977	6,493,152	209	200	276
Dist. 4: Lower Gulf-S.W.	1	2,813	2813	738	3,889,666	5271	690	3,615,759	5240	712	3,753,334	205	213	245
† Gulf of Mexico				10	100,811	10081	14	134,291	9592	15	151,189	3	9	9
Dist. 5 & 6 East Central and Northeast				571	2,766,367	4845	469	2,366,373	5046	604	2,926,633	180	153	210
Dist. 7-B & 9 North Central and North	7	13,093	1870	4,287	13,585,664	3169	3,226	10,358,193	3211	4,288	13,588,336	1,019	423	1,281
Dist. 7-C & 8 West Central and West				2,660	13,216,794	4969	2,426	13,153,595	5422	2,910	14,466,206	356	376	534
Dist. 10: Panhandle				668	2,527,104	3783	501	1,746,945	3487	802	3,033,896	37	22	88
Utah				72	338,641	4703	48	234,603	4888	83	390,359	47	30	63
West Virginia				350	921,950	2634	288	767,545	2504	375	988,050		10	25
Wyoming				444	2,080,138	4685	341	1,706,081	5003	446	2,089,862	103	79	137
Other States*				9	62,472	6941	9	59,234	6582	16	62,528	4	7	11
Total United States	99	266,440	2699	28,894	117,556,007	4069	26,069	106,161,616	4079	30,506	125,412,993	5,303	4,614	7,107

*Georgia, Idaho, Nevada, Maryland, North Carolina, Oregon, Tennessee and Washington.
†Gulf of Mexico wells included in South Louisiana and Texas Districts 3 and 4 figures.

Forecast of Wells and Footage to Be Drilled in 1956

Forecast covers all new wells to be drilled for oil or gas in 1956, salt-water disposal wells, and water or gas-input wells for repressuring and secondary recovery, but does not estimate old wells drilled deeper.

State or District	TOTAL NEW WELLS				WILDCAT TESTS			FOOTAGE (New Wells)			
	Forecast For 1956	Drilled In 1955	% Diff. '55-'56	% of U.S. 1956	Forecast For 1956	Drilled In 1955	% Diff. '55-'56	Forecast For 1956	Drilled In 1955	% Diff. '55-'56	% of U.S. 1956
Alabama	**95**	43	+120.9	0.1	**45**	41	+ 9.8	**570,000**	204,191	+179.2	0.2
Arizona	**3**	5	— 40.0	0.0	**2**	5	— 60.0	**14,000**	22,518	— 37.8	0.0
Arkansas	**910**	784	+ 16.1	1.5	**160**	151	+ 6.0	**2,912,000**	2,530,207	+ 15.1	1.2
California	**2,100**	2,469	— 15.0	3.6	**275**	388	— 29.1	**10,080,000**	12,141,529	— 17.0	4.1
Colorado	**1,325**	1,520	— 12.8	2.2	**700**	801	— 12.6	**7,155,000**	8,208,324	— 12.8	3.0
Florida	**12**	26	— 53.9	0.0	**12**	25	— 52.0	**70,000**	179,185	— 60.9	0.0
Illinois	**3,635**	3,908	— 7.0	6.2	**900**	771	+ 16.7	**8,517,000**	9,449,165	— 9.9	3.5
Indiana	**655**	634	+ 3.3	1.1	**200**	185	+ 8.1	**1,134,000**	1,006,909	+ 12.6	0.5
Kansas	**4,675**	4,669	+ 0.1	7.8	**1,220**	1,193	+ 2.3	**17,531,000**	17,605,365	— 0.4	7.2
Kentucky	**1,840**	1,782	+ 3.3	3.1	**155**	162	— 4.3	**2,653,000**	2,707,978	— 2.0	1.1
Louisiana	**3,750**	4,293	— 12.7	6.3	**600**	580	+ 3.4	**27,916,000**	28,417,781	— 1.8	11.5
North Louisiana	**1,525**	2,151	— 29.1	2.6	**190**	221	— 14.0	**5,530,000**	6,829,597	— 19.0	2.3
South Louisiana	**2,225**	2,142	+ 3.9	3.7	**410**	359	+ 14.2	**22,386,000**	21,588,184	+ 3.7	9.2
*Gulf of Mexico	**525**	360	+ 45.8	0.9	**85**	71	+ 19.7	**4,790,000**	3,559,274	+ 34.6	2.0
Michigan	**480**	512	— 6.3	0.9	**150**	197	— 23.9	**1,356,000**	1,524,610	— 11.2	0.5
Mississippi	**425**	462	— 8.0	0.8	**175**	192	— 8.9	**3,111,000**	3,370,283	— 7.7	1.3
Missouri	**25**	25	.....	0.0	**15**	18	— 16.7	**23,000**	13,696	+ 67.9	0.0
Montana	**460**	363	+ 26.7	0.8	**140**	153	— 8.5	**2,362,000**	1,746,638	+ 35.2	1.0
Nebraska	**1,100**	847	+ 29.9	1.8	**540**	386	+ 39.9	**6,292,000**	4,844,139	+ 29.9	2.6
New Mexico	**2,005**	1,726	+ 16.2	3.4	**250**	209	+ 19.6	**9,133,000**	7,354,782	+ 24.2	3.7
New York	**400**	402	— 0.5	0.7	**10**	13	— 23.1	**600,000**	619,097	— 3.1	0.3
North Dakota	**290**	253	+ 14.6	0.5	**85**	67	+ 26.9	**2,162,000**	1,794,669	+ 20.5	0.9
Ohio	**1,175**	1,214	— 3.2	1.9	**20**	16	+ 25.0	**2,585,000**	2,547,752	+ 1.5	1.0
Oklahoma	**8,240**	7,605	+ 8.3	13.9	**850**	777	+ 9.4	**29,664,000**	26,464,766	+ 12.1	12.3
Pennsylvania	**825**	761	+ 8.4	1.4	**15**	12	+ 25.0	**2,331,000**	1,837,578	+ 26.9	0.9
South Dakota	**15**	12	+ 25.0	0.0	**15**	12	+ 25.0	**75,000**	52,476	+ 42.9	0.0
Texas	**23,165**	19,953	+ 16.1	39.1	**5,480**	4,860	+ 12.8	**97,789,000**	87,565,959	+ 11.7	40.3
Dist. 1: S. Central	**2,105**	1,772	+ 18.8	3.6	**520**	435	+ 19.5	**5,694,000**	4,708,002	+ 20.9	2.4
Dist. 2: Middle Gulf	**950**	823	+ 15.4	1.6	**320**	313	+ 2.2	**5,913,000**	5,022,314	+ 17.7	2.4
Dist. 3: Upper Gulf	**1,870**	1,789	+ 4.5	3.1	**485**	463	+ 4.8	**12,428,000**	11,552,991	+ 7.6	5.1
Dist. 4: L. Gulf-S.W.	**1,450**	1,351	+ 7.3	2.5	**450**	470	— 4.3	**7,643,000**	7,192,881	+ 6.3	3.2
*Gulf of Mexico	**25**	26	— 3.9	0.0	**12**	11	+ 9.1	**252,000**	253,430	— 0.6	0.1
Dists. 5 & 6: East	**1,175**	1,035	+ 13.5	1.9	**390**	346	+ 12.7	**5,693,000**	5,099,945	+ 11.6	2.3
Dists. 7-B & 9: North	**8,575**	6,868	+ 24.9	14.5	**2,300**	1,888	+ 21.8	**27,174,000**	22,138,312	+ 22.7	11.2
Dist. 7-C & 8: West	**5,570**	5,340	+ 4.3	9.5	**890**	886	+ 0.5	**27,683,000**	21,864,008	+ 26.6	11.4
Dist. 10: Panhandle	**1,470**	975	+ 50.8	2.4	**125**	59	+111.9	**5,561,000**	3,462,547	+ 60.6	2.3
Utah	**155**	101	+ 53.5	0.3	**110**	86	+ 27.9	**729,000**	445,055	+ 63.8	0.3
West Virginia	**725**	639	+ 13.5	1.2	**25**	21	+ 19.0	**1,910,000**	1,683,815	+ 13.4	0.8
Wyoming	**890**	777	+ 14.5	1.5	**240**	226	+ 6.2	**4,170,000**	3,852,121	+ 8.3	1.7
Other States[1]	**25**	94	— 73.4	0.0	**15**	54	— 72.2	**125,000**	339,100	— 63.1	0.1
Total U.S.	**59,400**	55,879	+ 6.3	100.0	**12,404**	11,601	+ 6.9	**242,969,000**	228,529,688	+ 6.3	100.0

* Gulf of Mexico wells included in South Louisiana and Texas Districts 3 and 4 figures.
[1] Other states include Georgia, Idaho, Nevada, Maryland, North Carolina, Oregon, Tennessee, Virginia and Washington.

of 1956 totaled 28,894 wells compared with 26,069 during the same period in 1955, an increase of 10.8 percent.

In contrast with this rate of growth, a gain of only 2.3 percent is predicted for the remainder of the year. A greater growth undoubtedly would have been achieved had it not been for the steel strike.

Recognition also is given to the industry's normal activity trend of drilling more wells during the second half of the year than in the first six months.

In addition, there is always the desire of some companies to fulfill drilling obligations in the current year when it is a successful year—and 1956 will be for the oil industry.

Furthermore, as usual, this forecast by WORLD OIL is based on the drilling plans of numerous companies. Information received from companies drilling a substantial volume of U. S. wells showed they expected to drill more wells than they planned to drill at the beginning of the year.

In addition, general outlook of the industry is good. High consuming and producing rates will result in increased earnings, a factor sure to encourage heavy drilling volumes.

Biggest gain in Texas. Much of the increase forecast is expected to occur in Texas. It is predicted that 23,165 wells and 97¾ million feet of hole will be drilled in Texas during 1956, an increase of 3212 wells and 10¼ million feet of hole.

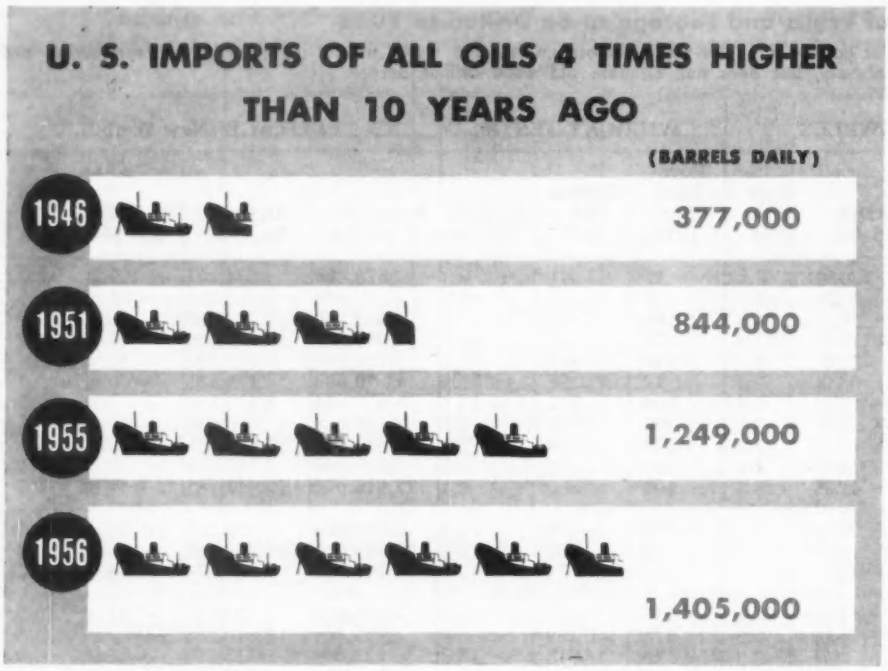
Much of Texas' gain will occur in the North Texas district, where 8575 wells are predicted against 6868 during 1955.

West Texas is seen as drilling 5570 wells in 1956, up 230 from 1955.

Other big increases. A big increase is expected in Oklahoma, with 8240 wells forecast for 1956 compared with 7603 in 1955.

New Mexico has a forecast of 2005 wells, in contrast with 1726 during 1955, a gain of 16.2 percent.

Another large gain is expected in Nebraska, where the completion of 1100 wells is predicted for this year. In 1955, Nebraska completed 847.



U. S. Imports . . . This year's total likely to be 12% over 1955 volume.

U. S. IMPORTS have been exceeding exports by increasing amounts. In the first half of 1956 total imports averaged about 1,385,000 barrels daily. That was 1,056,000 barrels per day more than the exports of about 329,000 daily.

For the second half of 1956 WORLD OIL estimates that imports will average about 1,426,000 barrels daily. That would be 1,084,000 barrels a day more than similarly estimated exports of 342,000 barrels daily.

For the whole year 1956, total imports of crude oil and products will average about 1,405,000 barrels per day, it is indicated. That would be 1,069,000 barrels a day more than the expected exports of about 336,000 barrels daily.

In the first half of 1956 the daily average total imports were 142,000 barrels daily or 11.4 percent above 1955. In the second half of this year the indicated imports will be 172,000 barrels daily or 13.7 percent above the latter half of last year. For 1956 as a whole, total oil imports of 1,405,000 barrels daily would be 156,000 barrels or 12.5 percent greater than imports in 1955.

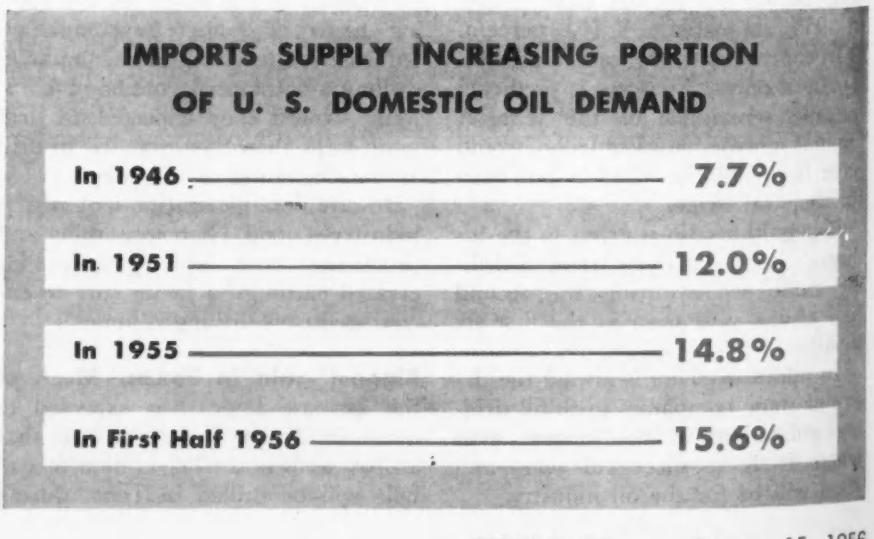
Of the petroleum imports coming into the U. S., about two thirds are crude oil and one third products. The crude oil includes large volumes of heavier grades. The products are predominantly residual fuel oil, bunker oil, and asphalt. These heavier crudes and products come principally from Mexico, Venezuela, and the Netherlands West Indies.

The heavy crudes and products supply a long established need of the U. S. for those particular oils. This need has become greater as U. S. refineries have increased their yields of lighter products and reduced the yields of residual fuel oils. The demand for residual has been accentuated by record breaking levels of industrial activity. Requirements of asphalt have been very great because of unprecedented residential, industrial, and commercial construction, involving much roofing material. Needs for asphalt and road oil have been large because of post-war highway construction. These latter needs will be even greater in the future because of the recently initiated 15 year U. S. highway program.

The products and heavy crudes from the Caribbean area and Mexico go principally to the East Coast. The West Coast imports very few products and no heavy crudes. But it is receiving increasing volumes of lighter crudes, as California's production fails to keep abreast of requirements. Crude imports to the West Coast are coming from South America, Canada, the Far East and the Middle East.

Besides the heavier crudes and products, lighter crudes are being imported in increasing volumes to the East Coast. Some Middle East crude is being shipped even into the Houston ship channel, on the Texas Gulf Coast. The crude oil imports to the East Coast are coming from South America, Canada, Kuwait, Iraq, Saudi Arabia, Qatar, the Neutral Zone, Iran and other sources. Several companies recently started their first importing, receiving their shares of cargoes from Iran, as members of the Iranian Consortium.

The U. S. total imports of 1,385,000 barrels daily in the first half of 1956 included 889,000 a day of crude and 496,000 daily of products. The crude receipts were 150,000 barrels or 20.2 percent greater than in the first half of 1955.



About 30 U. S. Companies Import 1 1/4 Million Barrels of Oil Per Day from Western and Eastern Hemisphere Sources

Table Shows U. S. Petroleum Imports, by Companies, by Sources

(Data as submitted by importing companies to Texas Railroad Commission, July 19, 1956.)

BARRELS DAILY

COMPANY	Source and Gravity API	June Actual	July Forecast
CRUDE OIL: EAST COAST			
Atlantic Refining Co.	Total, All Sources	70,500	71,700
	Venezuela, Total	47,800	57,100
	Venezuela—20-24°	7,700	4,700
	" —34-42°	16,700	21,000
	" —25-33°	8,900	20,000
	" —15-19°	14,500	11,400
	Kuwait—31-32°	4,000	2,700
	Iraq—35-36°	11,800	10,500
	Iran—34-35°	6,900	1,400
Cities Service Company	Total, All Sources	21,332	36,355
	Venezuela—10.3-17.5°[4]	3,844	11,774
	Mexico—11-19.4°[4]	3,700	0
	Kuwait—31.5°	13,788	24,581
Eastern States Pet. Co.	Middle East—24-31°	14,884	17,000
Gabriel Oil Company	Mexico—18°	8,500	6,452
Gulf Oil Corporation	Total, All Sources	167,000	149,000
	Venezuela, Total	84,000	84,000
	" —Above 25°	65,000	64,000
	" —Below 25°	19,000	20,000
	Middle East—Above 25°	83,000	65,000
Hancock Oil Company	Iran—34°	0	1,935
Lake Superior Ref. Co.	Canada—35°	5,300	4,194
McBride Oil & Gas Corp.	Mexico—20°	0	[6]
Phillips Petroleum Co.	Venezuela—26-41°	6,274	11,613
San Jacinto Pet. Corp.	Iran—34-35°	0	2,000
Signal Oil & Gas Co.	Iran—34.7°	0	1,484
Sinclair Oil Corporation	Total, All Sources	83,253	77,700
	Venezuela, Total	55,226	63,300
	" —35-43°	12,137	6,000
	" —30-35°	43,089	57,300
	Kuwait—30-34°	22,217	8,400
	Qatar—35-43°	5,810	6,000
Shell Oil Company	Canada—27°	958	1,000
Socony-Mobil Oil Co., Inc.	Total, All Sources	66,859	69,500
	Venezue a, Total	27,276	
	" —24-27°	3,833	
	" —30-35°	23,443	68,500
	Colombia—32-37°	19,671	
	Kuwait—31-33°	19,912	
	Saudi Arabia—34-36°	0	
Sohio Petroleum Co.	Iran—34°	0	1,935
Southwestern Oil & Ref. Co.	Mexico—Below 20°	3,711	0
Standard Oil Co. of Calif.	Total, All Sources	84,234	79,400
	Arabia—34°	54,945	51,800
	Venezuela, Total	29,289	27,600
	" —32°	3,992	0
	" Asphalt Crude	25,297	27,600
Standard Oil Co. (Indiana)	[4]Total, All Sources	20,993	16,800
	Venezuela Total	14,066	13,600
	" —26°	0	3,600
	" —10-19°	14,066	10,000
	Mexico—10-19°	6,927	3,200
Standard Oil Co. (N.J.)	[1]Total All Sources	90,000	66,000
	Venezuela Total	90,000	66,000
	" —Under 25°	63,000	53,000
	" —Over 25°	27,000	31,000
Sun Oil Company	Total, All Sources	64,463	58,065
	Iraq—36°	18,377	7,097
	Kuwait—31-33°	41,709	35,774
	Venezuela, Total	4,377	15,194
	" —34-35°	4,377	7,065
	" —41°	0	8,129
The Texas Company	Total, All Sources	80,693	81,774
	Venezuela, Total	44,681	35,161
	" —16-17°	6,962	6,290
	" —23-42°	37,719	28,871
	Saudi Arabia—34-35°	26,853	42,903
	Colombia—24-34°	9,159	3,710
	Trinidad—28-29°	0	0
Tidewater Oil Company	Total, All Sources	23,123	25,800
	Middle East, Total	15,979	20,000
	" " —Above 25°	9,908	14,200
	" " —Below 25°	6,071	5,800
	South America—Above 25°	7,144	5,800
Total Crude E. Coast		**812,077**	**797,707**
CRUDE OIL: WEST COAST			
Douglas Oil Co. of Calif.	Total, All Sources	0	3,968
	Ecuador—37°	0	3,968
	Peru—37°	0	0
Shell Oil Company[5]	Canada—33-35°	0	4,260
Socony Mobil Oil Co., Inc.	Total, All Sources	34,633	29,700
	Canada—38-42°	18,567	
	Venezuela—33-35°	16,066	
Standard Oil Co. of Calif.	Total, All Sources	16,028	39,500
	Canada—34°	0	12,200
	Sumatra—35°	16,028	23,400
	Venezuela—32°	0	3,900
The Texas Company	Total. All Sources	15,366	45,623
	Canada—37-42°	12,390	11,623
	Colombia—24°	0	0
	Saudi Arabia—34-35°	2,976	17,484
	Trinidad—29-30°	0	0
	Venezuela—29-36°	0	16,516
Tidewater Oil Company	Total, All Sources	58,086	40,700
	Canada—Above 25°	4,035	7,700
	Middle East, Total	38,070	7,000
	" " —Above 25°	31,146	0
	" " —Below 25°	6,924	7,000
	So. America—Above 25°	0	8,300
	Far East—Above 25°	15,981	17,700
Union Oil Co. of Calif.	Total, All Sources	6,900	10,000
	Venezuela, Total	6,900	10,000
	—24-25°	4,800	7,000
	—47-48°	2,100	3,000
Wilshire Oil Company	Total, All Sources	18,067	22,096
	Kuwait—31-32°	3,867	15,161
	Venezuela—38°	14,200	6,935
Total Crude W. Coast		**149,080**	**195,847**
Total Crude U.S.		**961,157**	**993,554**

COMPANY	Source and Description	June Actual	July Forecast
PRODUCTS: EAST COAST			
Asiatic Petroleum Corp.	Netherlands Antilles—Bonded Fuel Oil	(8,500)	(2,800)
Cities Service Company	Residual Fuel	0	0
Eastern States Pet. Co.	Mexico-Residuum Fuel Oil	9,718	10,000
Gabriel Oil Company	Mexico-Topped Crude	900	968
Gulf Oil Corporation	Unfinished Products—Venezuela	7,000	11,000
Shell Caribbean Pet. Co.[3]	Venez. and/or Netherlands Antilles-Res. Fuel	108,000	71,000
Shell Oil Company	Total, N. W. I.	14,099	16,451
	Total, N. W. I. Bonded	(5,533)	(8,161)
	Bunker C. Fuel Oil, N.W.I.	4,733	4,354
	Bunker C. Fuel Oil, N.W.I.	(5,033)	(7,677)
	Finished Asphalt, N.W.I.	9,366	12,097
	Heavy Marine Diesel, N.W.I.	(500)	(484)
Sinclair Oil Corporation	Venezuela—Gas Oil	0	0
Socony-Mobil Oil Co.	Bunker Fuel & Diesel, Bonded	(10,531)	(12,300)
	Asphalt	0	6,500
Standard Oil Co. of Calif.	Residual Fuel—10-14°	19,193	22,600
Standard Oil Co. (Ind.)[3]	Total, All Sources	87,000	94,000
Standard Oil Co. (N.J.)[7]	Total, All Sources, Bonded	(23,000)	23,000
	Venezuela—(—25°)	3,000	25,000
	" —(—25°)[1]	(7,000)	(5,000)
	" —(+25°)	0	0
	Netherlands—(—25°)	84,000	69,000
	" —(—25°)	(16,000)	(18,000)
Total Products E. Coast		**293,474**	**278,780**
PRODUCTS: WEST COAST			
The Texas Company	Bahrein—Unfinished Products	4,154	4,032
Total Products W. Coast		**4,154**	**4,032**
Total Products U.S.		**297,628**	**282,812**
Total Crude & Products E. Coast		**1,105,551**	**1,076,487**
Total Crude & Products W. Coast		**153,234**	**199,879**
Total Crude & Products U.S.		**1,258,785**	**1,276,366**
Total Bonded Fuel Oil		**(47,564)**	**(46,261)**
Total Crude & Products Less Bonded Fuel Oil U.S.		**1,211,221**	**1,230,105**

[1] June imports preliminary figure. July, August and September based on 3rd quarter 1956 Estimate; October and November based on 4th quarter Estimate.
[2] Shell Caribbean Petroleum Co. does not import either crude oil or products in its own name. The oil reported herewith was principally residual fuel oil sold to independent distributors on East Coast.
[3] Received through suppliers who can furnish either foreign or domestic fuel oil at his own election.
[4] Asphaltic Crudes.
[5] Indefinite due to Strike at Anacortes Refinery.
[6] Unable to forecast at this time.
[7] **Excludes** Bonded/Drawback for Foreign Flag International Bunkers as follows: June, Venezuela (—25°)— 11,000 B/D, Netherlands West Indies (—25°)— 28,000 B/D, Netherlands West Indies (+25°)— 3,000 B/D; 3rd quarter 1956 Venezuela (—25°)— 11,000 B/D; Netherlands West Indies (—25°)— 36,000 B/D; Netherlands West Indies (+25°)— 5 000 B/D; 4th quarter 1956, Venezuela (—25°)— 11,000 B/D; Netherlands West Indies (—25°)— 36,000 B/D; Netherlands West Indies (+25°)— 5,000 B/D.

U. S. Independent Operators' Interest Abroad Is Growing

Drilling contractors are joining this broadening trend toward expanded operations outside continental limits.

THE GROWING number of U. S. independent oil producing companies and drilling contractors operating abroad is a double-barreled tribute to their individual foresight and to the manner in which private capital can function beneath the progressive canopy of a healthy political establishment.

This significant trend has broadened the foundation of the oil and gas industry to include an international facet which will continue to exert mounting influences on the industry. This sizable expansion began unfolding after 1945, when only 20 U. S. companies were engaged in exploration and producing operations abroad. And about half of this number conducted activities on only a limited basis at that time.

Then, most of U. S. holdings abroad were the properties of the five big international U. S. companies—Standard Oil Company (New Jersey), Socony-Vacuum Oil Company (now Socony Mobil Oil Company), Standard Oil Company of California, Gulf Oil Corporation, and The Texas Company. Today, because of continuing expansion, the bulk of U. S. producing operations outside the U. S. still belongs to these five major companies.

However, a large number of U. S. oil producing companies and drilling contractors have entered the international oil business. In 1955 more than 100 large and small independent oil companies were engaged in some oil or gas production phase outside of the U. S. and Canada (see WORLD OIL, August 15, 1955, Page 123), in addition to the Big Five companies.

To the number listed in WORLD OIL August 15, 1955, may be added the following oil companies, which are active in one or more phases of oil and/or gas operations, and drilling contractors:

Alaska—Colorado Oil and Gas Corporation, Denver, which has obtained oil and gas exploration rights to 1.2 million acres in the Icy Bay-Cape Fairweather area; A. D. Rushing, Inc., Los Angeles, which drilled the world's northernmost well—a gas well near the Arctic ocean; Aledo Oil Company, Fort Worth, a drilling firm; and The Ohio Oil Company.

Australia—Brown Drilling Company, Long Beach, Calif., which entered into drilling operations in Australia in June, 1952, and which recently concluded its contract; Loffland Brothers Company, a drilling contractor which is operating one drilling rig for California-Texas Company; Oil Drilling and Exploration, Ltd.; and American Overseas Petroleum Company.

Bolivia—Bolivian Gulf Oil Company, which recently obtained exploration privileges to almost 8 million acres. Two officials of Falcon Seaboard Drilling Company, Tulsa, which is a part owner in the Bolivian company, were scheduled to complete the Bolivian Gulf exploration agreement with the government in 1956.

Brazil—Drilling and Exploration Company, Houston, is drilling for the government.

British Guiana—McBride Oil and Gas Corporation, San Antonio, has a concession.

British Somaliland—Amerada Petroleum Corporation, The Ohio Oil Company and Continental Oil Company jointly hold a concession area. The Moriqui Exploration Company of Los Angeles recently sold its concession acreage rights to Sandard-Vacuum Oil Company.

Chile—Santa Fe Drilling Company, Santa Fe Springs, Calif., is drilling for the government.

Colombia—Loffland Brothers Company, Tulsa, Okla., was scheduled to ship a rig to Colombia for Colombian Petroleum Company, a Socony subsidiary. John Mecom, Houston oilman, recently signed an agreement whereby he was to provide 75 percent and Colombian Oil Company 25 percent of the capital for a $20 million offshore oil venture in Tolu Bay and Morrosquillo Gulf under terms of a concession granted by the government. Forest Oil Corporation, Bradford, Pa., was scheduled to undertake a secondary recovery project. Cities Service Petroleum Corporation was to begin exploration operations in the southern part of the de Mares concession, which had been under litigation for 15 years between the government and Compania Explotadora del Carare, S. A.

Costa Rica—Loffland Brothers Company has been operating one rig continuously since June, 1954. Union Oil Company of California operates through a subsidiary, Compania Petrolera S. A.

Cuba—Americuba Petroleum Corporation, formerly Peerless Oil Company; Cia. Perforadora de Las Antillas, S. A.; Cia. Petrolera Arabia, S. A.; Atlantic Refining Company of Cuba; Union Petrolera Aurrera-Jarahueca, S. A.; Cuban American Drilling and Exploration Company, S. A.; Cuban Canadian Petroleum Corporation; Cuban Colombian Petroleum Company; Cuban Kewanee Oil Company; Cuban Oil Corporation; Cuban Stanolind Oil Company; Cuban Sulgraves Petroleum Company.

Cia. de Fomento Petrolero Ted Jones, S. A.; Kermac Contractors, Inc.; Perforaciones Oro Negro, S. A.; Santa Anna Petroleum Company; Sante Fe Petroleum Company; Siboney-Caribbean Petroleum Company (formerly Siboney Development and Exploration Company); Cia. Petrolera Trans-Cuba, S. A.

In addition, the following U. S. drilling contractors also maintain offices for Cuban operations:

Boaz Drilling Company, Cia. Petro-

lera de la Costa Norte, Delta Drilling Company, Dixie Drilling Company of Cuba, S. A.; Cia. Perforadora Jones de Cuba, S. A., Rotary Oil Drilling Company, and Simpson Oil Drilling Company of Cuba, S. A.

U. S. individuals and companies, including affiliates of major companies, interested in Cuba are:

The Atlantic Refining Company of Cuba; Union Petrolera Aurrera-Jarahueca, S. A.; Cuba California Oil Company, formerly Richmond Petroleum Company and California Exploration Company; Cuban American Drilling and Exploration Company, S. A.; Cuban Gulf Oil Company; Cuban Kewanee Oil Company; Cuban Oil Corporation.

Cuban Stanolind Oil Company; Esso Standard Oil, S. A. (Division de Cuba); Empresas Petroleras Ted Jones de Cuba, S. A.; Lee Oil Companies Company, S. A.; Perforaciones Oro Negro, S. A.; Siboney-Caribbean Petroleum Company, formerly Siboney Development and Exploration Company; Sun Oil Company; Texas Company (West Indies) Ltd.

Transcontinental Oil Corporation; newly-formed Pan Cuba Oil and Metals Corporation; Cullen Minerals Corporation; W. B. Duce, Beverly Hills, Calif.; Mike Benedum, Pittsburgh; Pacific Petroleums, Ltd.; and Caribbean Petroleum Associates.

Egypt—Camdrill International, Inc., a drilling subsidiary of Southern California Petroleum Corporation, has been awarded a two-year contract to drill for International Egyptian Oil Company.

France—Drilling and Exploration Company, D. D. Feldman Oil and Gas Inc.

Greece—The American Greek Oil Company, which was formed by a seven-man St. Louis group, has been granted an exploration concession for the island of Zakynthos, southernmost of the Ionian islands, by Greek government. Forest Oil Corporation has acquired oil exploration rights to the entire island of Cyprus, including offshore rights.

Guatemala—Signal Oil and Gas Company was scheduled to obtain a concession.

Haiti—In addition to the Kirkwood Drilling Company, Dallas, three Houston oil men were interested in Haiti; Mark Edwin Andrews and John Mecom, who share concession rights under a single acquisition, and John H. Blaffner, who also holds a concession interest. Also, Commonwealth Oil Company of Houston has acquired a 50-year concession.

Honduras—A group of oil men, including John W. Mecom and Ernest Cockrell, Jr., Houston, David C. McCord, O. R. Seagraves, Dallas, and the John Sullivan interests, San Antonio, have acquired a concession to 50 million acres of Honduras coastline.

Iran—Santa Fe Drilling Company will handle an exploration and drilling program for Iranian Oil Exploration and Producing Company, one of the two companies operating the Iranian oil industry under the consortium agreement.

Israel—Parker Drilling Company, Tulsa, has moved three rigs into Israel and was set up to operate seven more on a contract basis. Rimrock Tidelands, Inc., a Shreveport-based oil and uranium developing and producing company, has signed a management contract with Matsada United Drilling Company, Ltd., to supervise all Matsada's drilling operations in Israel. Matsada is the operating subsidiary of Lapidot-Israel Petroleum Company, Ltd., which brought in the Israeli discovery well in the Heletz region in September, 1955. Also interested in Israeli operations are Israel Middle Petroleum Company, an affiliate of William F. Buckley and Pantepec Oil Company, and Tri-Continent Drilling Company of Houston, also a Pantepec subsidiary.

Italy—Drilling and Exploration Company; Heathman-Seeligson Drilling Company of Wichita (a new company recently formed by Jack H. Heathman of Wichita and A. A. Seeligson, Jr., of San Antonio), which spudded in a contract well in March, 1956; Parker Drilling Company, which plans to drill if the Italian petroleum law is revised; and Molasse Erdol-Fordervogs AG (MOFAG), a company also organized by Heathman and Seeligson, which has a 50-50 exploration agreement with Snia Viscosa Corporation, a leading Italian industrial concern, covering 500,000 acres.

Italian Mandate of Somalia—Sinclair Somal Corporation was drilling at mid-1956 near Obbia as a concession operator for Amerada Petroleum Corporation, Continental Oil Company, Sinclair Oil Corporation, and The Ohio Oil Company.

Jamaica—E. L. Oliver Drilling Company operates on contract drilling basis and drilled the No. 1 Jamaica test.

Libya—Oasis Oil Company of Libya, wholly-owned subsidiary of The Ohio Oil Company will operate about 35 million acres of oil and gas exploration concessions owned one-third each by Ohio, Continental Oil Company and Amerada Petroleum Corporation. The Hunt oil interests of Dallas and Libyan American (Texas Gulf Producing, Houston) hold concessions. W. R. Grace and Company in May, 1956, acquired a 49 percent interest in Libyan American.

Mahra—Forest Oil Corporation has signed a concession in this area located between Dhofar and Aden.

Mexico—Del Mar Drilling Company has bought a controlling interest in Northeast Mexico Drilling Company, a drilling contracting firm.

Peru—In addition to listings published in 1955 (WORLD OIL, August 15, Page 123), these firms were engaged in Peru: Santa Fe Drilling Company; Skiles Oil Corporation, Mount Carmel, Ill.; Cerro de Pasco Corporation, a U. S. mining company; Petroleo Sullana, Ltd., which is held 40 percent by Union Oil Company; Peruvian Pacific Petroleum (Cities Service); and Douglas Oil Company of California, which was drilling offshore.

Pakistan—Southeastern Drilling Company was drilling a contract well in 1956 in West Pakistan.

Paraguay—Glenn McCarthy, Inc., reportedly was readying a drilling effort in 1956.

Philippines—Kern Drilling International was drilling a contract well in

1956 in the Cagayan valley of Luzon island for the Philippine Oil Development Company (a subsidiary of The Texas Company and Standard Oil Company of California). San Jose Oil Company (controlled by Pantepec) holds acreage under lease. White Eagle Overseas Company, a White Eagle Oil Company of Tulsa subsidiary, also was interested in the Philippines.

Sicily—Parker Drilling Company; Charles B. Wrightsman, Houston; Camay Drilling Company of California, which was preparing to assemble a rig with which to begin operations.

Switzerland—Molasse Erdol-Fordervogs AG (MOFAG), a company organized by Jack H. Heathman of Wichita and A. A. Seeligson, Jr., San Antonio.

Syria—Syrian American Oil and Gas Company has been formed by J. W. Menhall of Benton, Ill., to drill in the northeast region.

Trinidad—Brown Drilling Company, which began contract drilling operations in September, 1954.

Turkey—The following firms have been granted exploratory permits by the Turkish government: Kern Oil Company; D. D. Feldman Oil and Gas, Inc., whose operations were under way; Tide Water Associated Oil Company; Cities Service Middle East Corporation; Husky Oil Corporation; Bolsa Chica Oil Corporation; Seaboard Oil Company; Atlanta Refining Company; and Gilliland Oil Corporation, which was granted licenses for exploration and production on 250,000 acres in southeastern Turkey.

Uruguay—Thomas P. Pike Drilling Company was scheduled to drill contract wells for ANCAP, Uruguayan government agency; Dunlap and Graham.

Venezuela—Drilling contractors include Loffland Brothers Company, which first began Venezuelan drilling Jan. 1, 1946, and has drilled wells in western, eastern and central regions; Delta Drilling Company; Santa Fe Drilling Company; and Brown Drilling Company, which began Venezuelan operations in September, 1955, and whose second rig was being set up.

Oil companies included, in addition to the major companies and others published in the Aug. 15, 1955, issue of WORLD OIL, Phillips Petroleum Company, Pancoastal Oil Corporation, Coro Petroleum Company, Seaboard Oil Company of Delaware, Pantepec Oil Company, S. A., Talon Petroleum Company, Vimax Oil Company, C. H. Maury, Murmac Oil Company formed by Clint Murchison of Dallas and D. T. McDonald and others; and Venezuelan Leaseholds, S. A., a company formed by several U. S. independents, four Canadians and three Europeans to invest up to $400 million in oil operations. U. S. companies in Venezuelan Leaseholds are Boger Oil Company of Louisiana, Star Falcon Oil Company and Dade Petroleum Company.

Yemen—Yemen Development Corporation, Washington, D. C., has acquired the first over-all oil and mineral concession granted by Yemen.

Canada Draws Most. More American independents are operating in Canada than in any other country outside the U. S. In addition to the Big Five international U. S. companies, all the remaining companies which comprise the 23 largest U. S. producing companies also are active in Canadian operations.

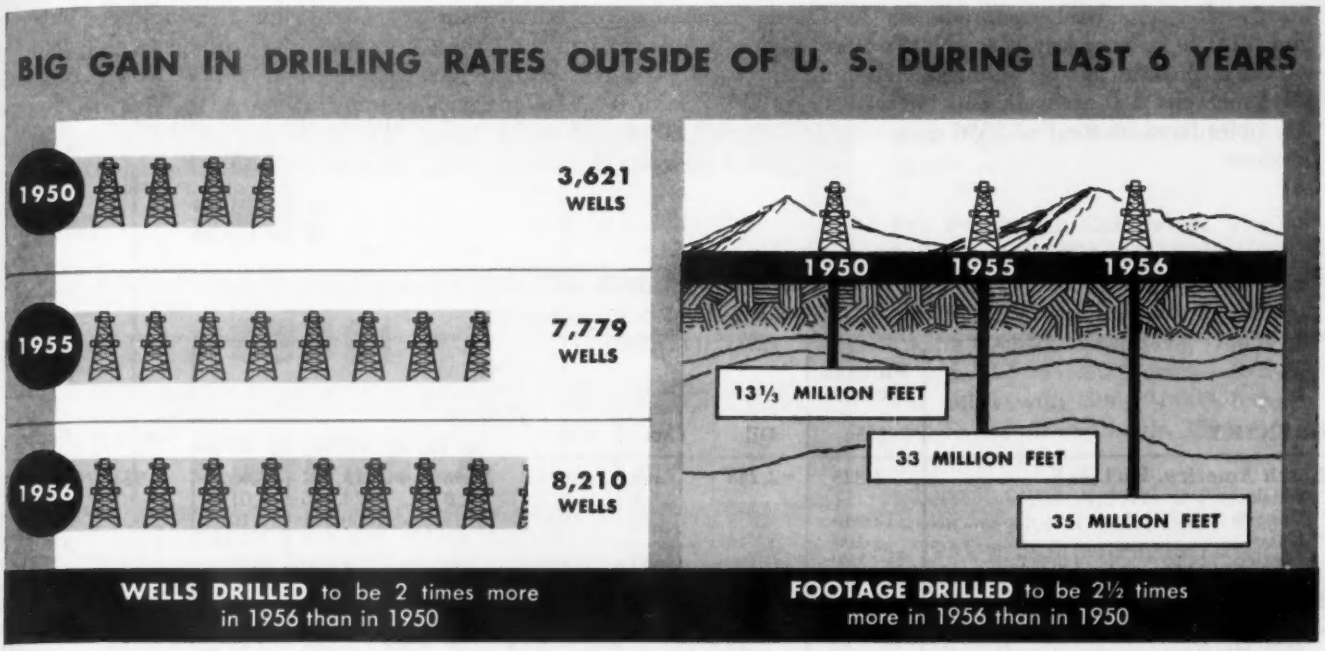
The following table lists many of the companies now operating in Canada.

U. S. OIL COMPANIES OPERATING IN CANADA

Canadian Affiliate	U. S. Company
Amerada Petroleum Corporation	Amerada Petroleum Corporation
American Northland Oil Company	
Amurex Oil Development Company	Ashland Oil & Refining Company; Murphy Corporation
Antone Petroleum Limited	Ranger Oil Co., Ltd.; Antone Oils
Aquila Petroleum, Ltd.	Imperial Oil Limited
Bay Petroleum Corporation	Bay Petroleum Corporation
Bear Oil Company	Sunray Mid-Continent Oil Corp. Sunray and others
Benedum & Trees	Benedum & Trees
Bonanza Oil & Mine Corporation	Bonanza Oil & Mine Corporation
British American Oil Co., Ltd.	Gulf Oil Corporation
California Standard Company	California Standard Company
Canada-Cities Service Petroleum Co.	Cities Service Oil Company
Canada Southern Oils, Ltd.	Canadian Southern Oils, Inc.; Gulf Coast Leaseholds, Inc.; and others
Canadian Atlantic Oil Co., Ltd.	
Canadian Bishop Oil Ltd.	Bishop Oil Company
Canadian British Empire Oil Co., Ltd.	Arrow Drilling Co.
Canadian Delhi Oil Ltd.	Delhi Oil Corporation and others
Canadian Superior Oil of Calif., Ltd.	Superior Oil Company
Canadian Gulf Oil Company	Gulf Oil Corporation
Canadian Seaboard Oil Co.	Honolulu Oil Corp.; Sunray-Mid-Continent; Union of Calif.
Canuck Freehold Royalties Limited	Empire Trust Co.; Lehman Corp.
Catawba Corporation	Catawba Corporation
Charter Oil Company, Ltd.	Pacific Petroleum; Canadian Atlantic Oil Co., Ltd.
Cleary Oil Company, Ltd.	Cleary Oil Company, Ltd.
Christie, Mitchell & Mitchell Co.	Christie, Mitchell & Mitchell Co.
Colorado Oil & Gas Ltd.	Colorado Oil & Gas Corporation
Crosby Oil Corp., Ltd.	Crosby Oil Corp., Ltd.
Deep Rock Oil Corp.	Deep Rock Oil Corp.
Deep Valley Petroleum Co., Ltd.	San Juan Exploration Company
Fargo Oils Ltd.	General American Oil Co. of Texas
D. D. Feldman Oil & Gas Co., Ltd.	D. D. Feldman Oil & Gas Co., Ltd.
Felmont Oil Corporation	American Maracaibo Company
Hewitt Oil Company	W. B. Cleary, Inc.
Howard Oil Company	
Hudson's Bay Oil & Gas Co., Ltd.	Continental Oil Company and Hudson's Bay Co.
Husky Oil & Refining Ltd.	
Honolulu Oil Corporation	Honolulu Oil Corporation
Imperial Oil Limited	Standard Oil Co. (N. J.)
International Petroleum Corp.	International Petroleum Corp.
Lario Canadian Oil Company	Lario Oil & Gas Co.; Globe Oil & Refining
Long Island Petroleums Ltd.	Long Island Petroleums Co.
Los Nietos Company	Union Oil Co. of California
McCarthy & Coleman & Fain & McGaha	McCarthy & Coleman & Fain & McGaha
McColl-Frontenac Oil Company, Ltd.	The Texas Company
C. L. McMahon, Inc.	
Northern Natural Gas Producing Co.	Northern Natural Gas Company
The Ohio Oil Company	The Ohio Oil Company
J. P. Owen	Owen Drilling Company
Pacific Western Oil Co., Ltd.	Pacific Western Oil Corp.
Phillips Petroleum Company	Phillips Petroleum Company
Richfield Oil Corporation	Richfield Oil Corporation
Sapphire Petroleum Limited	Sapphire American Petroleum, Inc.
Seaboard Oil Company	Seaboard Oil Company
Sharples Oil (Canada) Ltd.	Sharples Oil Corporation
Shell Oil Company of Canada, Ltd.	Shell Oil Company
Signal Oil & Gas Company	Signal Oil & Gas Company
Sinclair Canada Oil Company	Sinclair Oil & Gas Company
Socony-Vacuum Oil Co. of Canada, Ltd.	Socony-Vacuum Oil Co., Ltd.
Sohio Petroleum Company	Standard Oil Company of Ohio
Southern Production Company, Inc.	Southern Prdouction Co., Inc.
Stanolind Oil & Gas Company	Stanolind Oil & Gas Co.
Sun Oil Company	Sun Oil Company
Tennessee Gas Transmission Co.	Tennessee Gas Transmission Co.
Texaco Exploration Co.	The Texas Company
Texas Calgary Company	Texas Calgary Company
Tidewater Oil Co., Operator	Tidewater Oil Co.; The Atlantic Refining Co.; The Ohio Oil Company
Union Oil Company of California	Union Oil Company of California
Woodley Canadian Oil Co.	Woodley Petroleum Co.

U. S. DRILLING COMPANIES OPERATING IN CANADA

Canadian Affiliate	U. S. Company	Rigs in Canada
American Northland Drilling Company	American Northland Drilling Company	2
Arrow Drilling Company Canada Limited	Arrow Drilling Company	6
Brinkerhoff Drilling Co., Ltd.	Brinkerhoff Drilling Co.	13
Can Tex Drilling Company	H. W. Bass Drilling Co.	12
Capay Drilling, Ltd.	- - - -	1
Dallas Drilling Co. Ltd.	- - - -	2
Donnell Drilling Ltd.	R. Donnell	3
R. L. Lee Drilling Co., Ltd.	- - - -	3
Loffland Brothers Co. of Canada	Loffland Brothers Company	7
Lohmann-Johnson Drilling Co., Ltd.	Lohmann-Johnson Drilling Co., Inc.	2
Parker Drilling Company of Canada, Ltd.	Parker Drilling Co.	10
Reading and Bates Drilling Co.	Reading and Bates, Inc.	7
Trinity Canadian Drilling Co.	Trinity Drilling Co.	4



World Completions and Footage . . . Total of 67,610

Free World wells by year's end is predicted . . . 6.2 percent jump.

A TOTAL OF 67,610 wells will be drilled in the Free World by year's end, WORLD OIL forecasts. This estimate reflects an increase of 6.2 percent, or 3952 wells, from 1955, when 63,658 wells were drilled. By comparison, 5069 more wells were drilled during 1955 than in the previous year, tantamount to an increase of 8.7 percent.

The 1956 forecast therefore, also will mirror an increase in footage drilled, a major factor in gaging drilling activity. In 1955, 261,721,660 feet was drilled for an average depth per well of 4111 feet. In 1954, 58,589 completions accounted for total footage drilled of 238,837,121 feet, or an average of 4076 feet.

Wells drilled last year resulted in 36,288 oil wells, 4106 gas wells and 23,264 dry holes.

As in the past, years' forecasts the bulk of the wells forecast for 1956—59,400 in number—will be drilled in the U. S., with 8210 wells spread throughout the remainder of the Free World.

Thanks to accelerated drilling programs in Canada and Mexico, North America, excluding the U. S., is expected to account for 3825 wells by year's end to lead the South American sector. With Venezuela accounting for the third largest country drilling program with 1200 wells, South America is expected to record a total of 2361 wells drilled this year.

Venezuela's estimated drilling total is but 33 completions less than the figure forecast for the whole of Western Europe—1233 wells. West Germany, with an expected 600 completions this year, remained in the No. 1 country drilling position in Western Europe.

With 45 wells forecast for both Algeria and Morocco by year's end, Africa is expected to account for a total of 147 wells this year. The Middle East, where a major share of the world's oil is found, will drill only 168 wells this year. Four hundred and sixty-six wells is the total forecast for the Far East and Oceania.

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Footage Drilled. Exclusive of the U. S., where footage drilled in 1955 amounted to 228,529,688 feet, total footage drilled in North America was 14,633,182 feet and resulted in an average depth per well of 4069 feet for each of the 3596 wells drilled in the year. The U. S. accounted for 55,879 wells with an average depth per well of 4090 feet.

In South America, the average depth of wells drilled last year was the greatest—4931 feet. A total of 2354 wells resulted in a footage drilled figure of 11,608,161 feet.

Comparing closely in average well depth were the Middle East and Africa categories. In the former, 113 wells were drilled to a total of 543,036 feet for an average depth per well of 4806 feet. In Africa, 131 wells accounted for total drilling footage drilled of 634,495 feet, or an average of 4843 feet per well.

Drilling Results. The U. S., in accounting for the single greatest number of completions—55,879—reported

31,183 oil wells, 3460 gas producers and 21,236 failures last year. North America, outside the U. S., reported 2245 oil wells, 260 gas wells and 1091 dry holes from its total of 3596 completions.

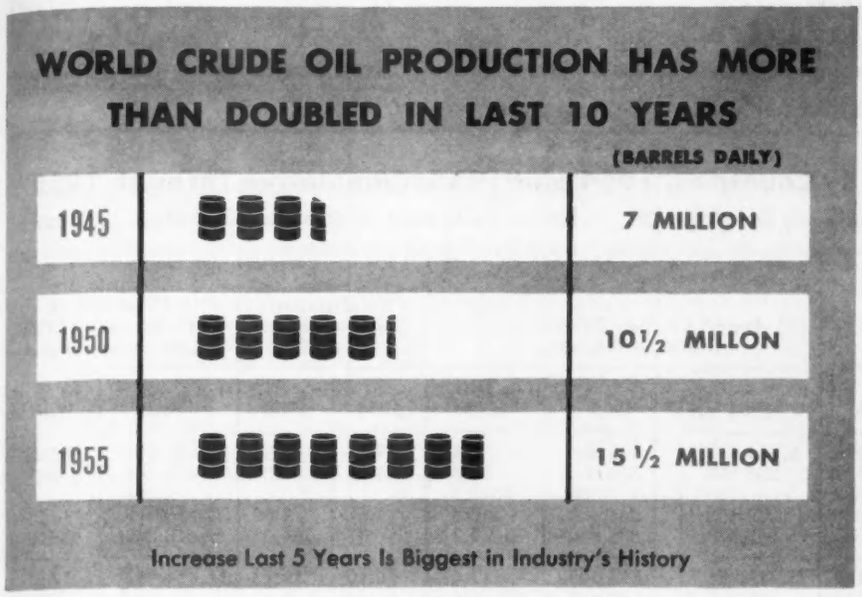
Of the remaining geographic categories, South America had the largest number of oil producers drilled last year—1936. Again, it was Venezuela which played its normal major role. That nation completed 1026 oil wells.

Credit for the largest number of natural gas producers, outside the U. S. and other North American countries, went to Western Europe. There, a total of 250 gas wells was drilled in 1955.

WORLD DRILLING ACTIVITY

(Exclusive of U. S. S. R. and Satellites)

COUNTRY	Forcast Wells in 1956	1955						1954	
		Oil	Gas	Dry	Total Wells	Footage	Average Depth	Wells	Footage
North America, Excl. U.S.	**3,825**	**2,245**	**260**	**1,091**	**3,596**	**14,633,182**	**4,069**	**2,933**	**10,992,248**
Alaska	.....	.....	1	5	6	24,105	4,017	1	4,837
Canada	3,345	2,013	223	929	3,165	12,569,441	4,101	2,608	9,355,971
Cuba	100	44	.....	51	95	249,831	2,630	31	80,000
Mexico	380	188	36	106	330	1,789,805	5,424	293	1,551,440
South America	**2,361**	**1,936**	**31**	**387**	**2,354**	**11,608,161**	**4,931**	**1,891**	**9,895,924**
Argentina	255	189	9	61	259	1,486,182	5,738	242	677,000
Bolivia	30	19	.....	2	21	75,878	3,613	13	58,446
Brazil	85	33	4	36	73	174,281	2,387	56	163,487
Chile	65	25	8	25	58	389,740	6,720	40	288,584
Colombia	110	102	.....	15	117	725,905	6,204	123	759,498
Ecuador	200	200	1	15	216	332,200	1,538	170	260,980
Peru	200	152	3	64	219	894,589	4,085	209	751,149
Trinidad	210	190	6	32	228	987,567	4,331	202	911,242
Uraguay	6	.....	.....	.....	.....	.....	....	.....	.....
Venezuela	1,200	1,026	.....	137	1,163	6,541,819	5,625	836	6,025,538
Central America and Caribbean Area	**10**	.....	.....	.....	.....	.....	....	2	**16,430**
Western Europe	**1,233**	**541**	**250**	**320**	**1,111**	**4,436,073**	**3,993**	**867**	**3,989,466**
Austria	140	113	4	6	123	584,348	4,751	108	542,837
Denmark	1	.....	.....	.....	.....	.....	....	.....	.....
France	125	27	2	63	92	439,975	4,782	53	308,760
Germany, West	600	358	26	183	567	2,409,140	4,249	518	2,198,804
Great Britain	30	10	1	15	26	70,475	2,711	15	45,520
Greece	2	.....	.....	.....	.....	.....	....	2	17,150
Italy and Sicily	300	17	215	44	276	821,085	2,975	101	620,087
Netherlands	25	16	1	.....	17	70,800	4,165	62	212,560
Portugal	.....	.....	.....	.....	.....	.....	....	2	20,105
Spain	10	.....	1	9	10	40,250	4,025	4	16,370
Switzerland	.....	.....	.....	.....	.....	.....	....	2	7,273
Africa	**147**	**31**	**7**	**93**	**131**	**634,495**	**4,843**	**175**	**845,049**
Algeria	45	6	4	34	44	228,361	5,190	76	244,000
Egypt	20	10	.....	3	13	29,600	2,277	10	38,397
Morocco	45	4	.....	35	39	184,890	4,740	55	251,860
Tunisia	5	.....	1	5	6	35,566	5,928	12	86,893
Other Africa	32	11	2	16	29	156,078	5,382	22	223,899
Middle East	**168**	**95**	.....	**18**	**113**	**543,036**	**4,806**	**90**	**424,925**
Bahrain Island	15	14	.....	1	15	58,069	3,871	23	61,360
Iran	25	8	.....	.....	8	21,200	2,650	.....	.....
Iraq	25	20	.....	.....	20	140,133	7,007	20	135,884
Israel	15	.....	.....	.....	.....	.....	....	1	1,800
Kuwait	25	21	.....	1	22	96,000	4,364	13	56,638
Neutral Zone	15	13	.....	2	15	58,754	3,917	14	41,128
Qatar	8	6	.....	3	9	54,720	6,080	4	30,017
Saudi Arabia	10	3	.....	4	7	48,000	6,855	8	53,950
Turkey	22	10	.....	6	16	53,660	3,354	6	31,560
Other Middle East	8	.....	.....	1	1	12,500	3,354	1	12,588
Far East and Oceania	**466**	**257**	**98**	**119**	**474**	**1,337,025**	**2,821**	**434**	**1,376,921**
Australia	10	3	.....	33	36	150,289	4,175	5	26,488
Indonesia	130	120	.....	13	133	266,863	2,006	130	410,067
Japan	220	76	95	47	218	547,097	2,510	203	506,247
New Guinea	20	5	.....	15	20	52,133	2,607	32	78,000
New Zealand	5	.....	.....	1	1	3,000	600	1	2,250
Sarawak-Brunei (Br. Borneo)	40	34	.....	.....	34	209,861	6,172	34	182,456
Other Far East	41	19	3	10	32	107,782	3,368	29	171,413
Total Free World Outside U.S.	**8,210**	**5,105**	**646**	**2,028**	**7,779**	**33,191,972**	**4,267**	**6,392**	**27,540,963**
United States	**59,400**	**31,183**	**3,460**	**21,236**	**55,879**	**228,529,688**	**4,090**	**52,197**	**211,296,158**
Total Free World	**67,610**	**36,288**	**4,106**	**23,264**	**63,658**	**261,721,660**	**4,111**	**58,589**	**238,837,121**



World Crude Production . . .

Middle East helps boost 1955 figure.

WITH A SIGNIFICANT assist from the Middle East, 1955 world crude production increased 12.1 percent (609,883,000 barrels) over 1954 for a new record annual total of 5,640,894,000 barrels.

Daily production averaged 15.5 million barrels last year—5 million barrels more than was produced in 1950 and more than double the world production total of 7 million barrels daily in 1945.

Last year's new production record increased the world's cumulative production total (through 1955) to 89.8 billion barrels, almost half of which has been produced in the last ten years.

Among the Free World's three top oil producing regions, the Middle East—second largest producer—had the sharpest production increase, 18.1 percent or 495,540 barrels a day more than was produced in 1954. Daily production averaged 3,233,358 barrels for an annual total of 1,180,187,000 barrels—20.92 percent of the world total. The Middle East accounted for 16.9 percent of the world's production in 1950 and only 7.5 percent in 1945.

The third largest producer, South America, reported the next largest production increase with a 12.4 percent (274,781 barrels a day) gain over 1954. Annual production totaled 910,160,000 barrels for a daily average of 2,157,196 barrels, 16.13 percent of the world supply.

Although third in percentage increase, North America still leads the world in crude production with a daily average of 7,407,368 barrels in 1955. Annual production totaled 2,703,715,000 barrels (an 8.4 percent increase over 1954), accounting for 47.93 percent of the world's production.

Figures on world production of crude oil used in this article and shown in the accompanying tables are from annual data compiled from private sources and estimated by WORLD OIL. Cumulative totals are based on these figures, together with U. S. Bureau of Mines data.

Top Producing Countries. The U. S. produced 2,484,521,000 barrels of crude in 1955, 3½ times more than the second largest Free World oil producing country, Venezuela, which reported 787,384,000 barrels. Kuwait was third with 398,494,000 barrels, and Saudi Arabia with 352,240,000 barrels was fourth.

Russia, third in total world crude output, produced 514,433,000 barrels in 1955, a 21.6 percent increase over 1954. Daily production averaged 1,409,392 barrels, 9.12 percent of the world total.

Accounting for 44.05 percent of the world's production, the U. S. averaged 6,806,842 barrels daily last year, a 7.3 percent or 464,469 barrels a day increase over 1954. This compares with a 1.7 percent decrease reported in 1954.

North America. (Outside U. S.). Canada, Mexico and Cuba reported production gains in 1955.

South America. Still South America's top producer, Venezuela averaged 2,157,196 barrels a day last year—13.7 percent or 267,519 barrels a day more than in 1954.

Middle East. Kuwait, after losing the

MIDDLE EAST PRODUCES INCREASING PORTION OF WORLD'S OIL

YEAR	AREA	BARRELS DAILY	PERCENT OF WORLD
	UNITED STATES	4,695,000	66.0
1945	MIDDLE EAST	532,000	7.5
	ELSEWHERE	1,882,000	26.5
	UNITED STATES	5,407,000	51.9
1950	MIDDLE EAST	1,756,000	16.9
	ELSEWHERE	3,256,000	31.3
	UNITED STATES	6,807,000	44.0
1955	MIDDLE EAST	3,233,000	20.9
	ELSEWHERE	5,414,000	35.1

Middle East now produces 6 times more than in 1945, and supplies 1/5 of world's oil.

title to Saudi Arabia in 1954, once again was the top oil producing country in the Middle East, averaging 1,091,754 barrels of crude a day in 1955, a 14.66 percent increase over the previous year. Saudi Arabia, averaging 965,032 barrels a day, gained only 1.3 percent over 1954, compared with a 12.8 percent increase in 1954 over 1953.

Iran continued its fast rising production rate in 1955.

World Crude Oil Production, By Countries, 1954 and 1955, Cumulative Through 1955

(Sources: Annual data from private sources or estimates by WORLD OIL. Cumulative totals based on U. S. Bureau of Mines 1953 data.)

CONTINENT and COUNTRY	Annual Production (Thousands of Barrels)		Daily Average Production (Actual Barrels)			Year's Production As Percent of World		Cumulative Production To January 1, 1956 (Thousands of Barrels)	
	1954	1955	1954	1955	% Diff. '54-'55	1954	1955	Total	As % of World
North America	**2,494,761**	**2,703,715**	**6,834,897**	**7,407,368**	**+ 8.4**	**49.58**	**47.93**	**56,105,266**	**62.47**
Canada	96,080	129,452	263,230	354,660	+ 34.7	1.90	2.29	606,762	0.67
Cuba	57	382	156	1,046	+570.2	.....	0.01	2,901	....
Mexico	83,636	89,360	229,138	244,820	+ 6.8	1.67	1.58	2,882,377	3.21
United States	2,314,988	2,484,521	6,342,373	6,806,842	+ 7.3	46.01	44.05	52,613,226	58.59
South America	**809,864**	**910,160**	**2,218,784**	**2,493,565**	**+ 12.4**	**16.10**	**16.13**	**11,354,947**	**12.65**
Argentina	29,590	30,457	81,067	83,443	+ 2.9	0.59	0.54	596,008	0.67
Barbadoes	.....	.....	.....	.....	.....	.....	.....	8	....
Bolivia	1,695	2,692	4,644	7,375	+ 58.8	0.03	0.04	11,624	0.01
Brazil	992	2,014	2,718	5,518	+103.0	0.02	0.04	6,342	....
Chile	1,736	2,577	4,756	7,060	+ 48.4	0.04	0.04	7,871	0.01
Colombia	39,621	39,363	108,550	107,843	— 0.7	0.79	0.70	701,259	0.79
Ecuador	3,146	3,531	8,619	9,674	+ 12.2	0.06	0.07	64,221	0.07
Peru	17,162	17,246	47,019	47,249	+ 0.5	0.34	0.30	484,409	0.54
Trinidad	23,628	24,896	64,734	68,207	+ 5.4	0.47	0.44	526,068	0.58
Venezuela	692,294	787,384	1,896,677	2,157,196	+ 13.7	13.76	13.96	8,957,137	9.98
Europe	**564,925**	**675,222**	**1,547,725**	**1,849,906**	**+ 19.5**	**11.23**	**11.97**	**10,873,086**	**12.10**
Albania	1,560	1,871	4,274	5,126	+ 19.9	0.03	0.03	25,293	0.02
Austria	23,079	24,886	63,230	68,180	+ 7.8	0.46	0.44	173,063	0.20
Czechoslovakia	947	1,117	2,594	3,060	+ 18.1	0.02	0.02	9,073	0.01
France	3,591	6,409	9,838	17,559	+ 78.5	0.07	0.12	32,280	0.03
Germany	18,930	22,345	51,862	61,219	+ 18.0	0.38	0.39	185,750	0.21
Great Britain	435	394	1,192	1,079	— 9.4	.....	0.01	6,791	0.01
Hungary	8,362	10,970	22,909	30,055	+ 31.2	0.17	0.20	81,096	0.09
Italy and Sicily	889	2,536	2,436	6,948	+185.3	0.02	0.04	8,257	0.01
Netherlands	6,526	7,137	17,879	19,553	+ 9.4	0.13	0.13	43,902	0.05
Poland	1,910	2,800	5,233	7,671	+ 46.6	0.04	0.05	289,530	0.32
Rumania	74,350	78,588	203,697	215,308	+ 5.7	1.47	1.39	1,538,524	1.71
U.S.S.R. (Russia)	422,881	514,433	1,158,567	1,409,392	+ 21.6	8.41	9.12	8,470,462	9.43
Yugoslavia	1,465	1,736	4,014	4,756	+ 18.5	0.03	0.03	9,065	0.01
Africa	**15,219**	**13,932**	**41,695**	**38,170**	**— 8.0**	**0.30**	**0.25**	**235,493**	**0.27**
Algeria	575	434	1,575	1,189	— 24.5	0.01	0.01	2,225	....
Egypt	13,760	12,740	37,698	34,904	— 7.4	0.27	0.22	228,651	0.26
Morocco	884	758	2,422	2,077	— 14.3	0.02	0.02	4,617	0.01
Asia, Total	**1,146,234**	**1,337,842**	**3,140,337**	**3,665,286**	**+ 16.7**	**22.78**	**23.71**	**11,232,371**	**12.50**
Asia, Middle East	**999,313**	**1,180,187**	**2,737,818**	**3,233,358**	**+ 18.1**	**19.86**	**20.92**	**8,546,772**	**9.51**
Bahrain	10,991	10,982	30,112	30,087	— 0.1	0.22	0.19	175,865	0.19
Iran	21,316	120,137	58,399	329,139	+463.6	0.43	2.13	2,674,406	2.98
Iraq	228,468	246,479	625,934	675,279	+ 7.88	4.54	4.37	1,383,356	1.54
Kuwait	347,557	398,494	952,202	1,091,754	+ 14.66	6.90	7.07	1,823,364	2.03
Neutral Zone	5,991	8,848	16,414	24,241	+ 47.7	0.12	0.15	14,839	0.02
Qatar	36,732	41,808	100,635	114,541	+ 13.8	0.73	0.74	165,847	0.18
Saudi Arabia	347,845	352,240	952,991	965,032	+ 1.3	6.91	6.25	2,306,809	2.57
Turkey	413	1,199	1,131	3,285	+190.3	0.01	0.02	2,286	...
Asia, Far East	**146,921**	**157,655**	**402,519**	**431,928**	**+ 7.3**	**2.92**	**2.79**	**2,685,599**	**2.99**
Burma	1,550	1,618	4,246	4,433	+ 4.4	0.03	0.03	} 368,692	0.41
India	2,235	2,526	6,123	6,921	+ 13.0	0.04	0.04		
Pakistan	1,948	2,068	5,337	5,666	+ 6.2	0.04	0.04		
China	11,000	13,200	30,137	36,164	+ 20.0	0.22	0.23	32,427	0.04
Indonesia	80,300	85,921	219,998	235,398	+ 7.0	1.60	1.53	1,625,353	1.81
Japan	2,157	2,229	5,910	6,107	+ 3.3	0.04	0.04	109,421	0.12
New Guinea	4,370	3,418	11,972	9,364	— 21.8	0.09	0.06	16,691	0.02
Sakhalin	7,000	7,300	19,178	20,000	+ 4.3	0.14	0.13	129,540	0.14
Sarawak-Brunei	36,326	39,351	99,522	107,810	+ 8.3	0.72	0.69	403,124	0.45
Taiwan (Formosa)	35	24	96	66	— 31.3	.....	.....	423	....
Australia-New Zealand	**8**	**23**	**22**	**63**	**+187.5**	**0.01**	.....	**114**	....
World, Undistributed	.....	.....	.....	.....	.....	.....	.....	**1,044**	**0.01**
TOTAL WORLD	**5,031,011**	**5,640,894**	**13,783,460**	**15,454,358**	**12.1**	**100.00**	**100.00**	**89,802,321**	**100.00**

World Crude Oil Production, By Countries, By Years (Part 1)

(Complete production history of world, in thousands of barrels of 42 U. S. Gallons. Sources: U. S. Bureau of Mines annual reports, *Mineral Resources and Minerals Yearbook*, and monthly reports, International Petroleum Trade and World Petroleum Statistics, except as otherwise indicated.)

World and North America, 1857-1895

YEAR	World Total	Percent Produced by U. S.	Canada	United States	Total North America
1856	....	....	....	....	....
1857	2	....	....	....	....
1858	4	....	....	....	....
1859	6	31	....	2	2
1860	509	98	....	500	500
1861	2,131	99	....	2,114	2,114
1862	3,092	99	12	3,057	3,069
1863	2,763	94	83	2,611	2,694
1864	2,304	92	90	2,116	2,206
1865	2,716	92	110	2,498	2,608
1866	3,899	92	175	3,598	3,773
1867	3,709	90	190	3,347	3,537
1868	3,990	91	200	3,646	3,846
1869	4,696	90	220	4,215	4,435
1870	5,799	91	250	5,261	5,511
1871	5,730	91	270	5,205	5,475
1872	6,877	92	308	6,293	6,601
1873	10,838	91	365	9,894	10,259
1874	11,933	92	169	10,927	11,096
1875	9,977	88	220	8,788	9,008
1876	11,051	83	312	9,133	9,445
1877	15,754	85	312	13,350	13,662
1878	18,417	84	312	15,397	15,709
1879	23,601	84	575	19,914	20,489
1880	30,018	88	350	26,286	26,636
1881	31,993	86	275	27,661	27,936
1882	35,704	85	275	30,350	30,625
1883	30,255	78	250	23,450	23,700
1884	35,969	67	250	24,218	24,468
1885	26,765	59	250	21,859	22,109
1886	47,243	59	584	28,065	28,649
1887	47,807	59	526	28,283	28,809
1888	52,165	53	695	27,612	28,307
1889	61,507	57	705	35,164	35,869
1890	76,633	60	795	45,824	46,619
1891	91,100	60	755	54,293	55,048
1892	88,739	57	780	50,515	51,295
1893	92,038	53	798	48,431	49,229
1894	89,337	55	829	49,344	50,173
1895	103,692	51	726	52,892	53,618

World and North America, 1896 to Now

YEAR	WORLD TOTAL	Percent Produced by U.S.	NORTH AMERICA				
			Canada	Mexico	United States	Cuba	Total North America
1896	114,199	53	727	.....	60,960	.....	61,687
1897	121,992	50	710	.....	60,476	.....	61,186
1898	124,979	44	758	.....	55,364	.....	56,122
1899	131,147	44	808	.....	57,071	.....	57,879
1900	149,137	43	913	.....	63,621	.....	64,534
1901	167,440	41	757	10	69,389	.....	70,156
1902	181,809	49	531	40	88,767	.....	89,338
1903	194,879	52	487	75	100,461	.....	101,023
1904	217,948	54	553	126	117,081	.....	117,760
1905	215,091	63	634	251	134,717	.....	135,602
1906	213,263	59	569	502	126,494	.....	127,565
1907	263,957	63	789	1,005	166,095	.....	167,889
1908	285,287	63	528	3,933	178,527	.....	182,988
1909	298,709	61	421	2,714	183,171	.....	186,306
1910	327,763	64	316	3,634	209,557	.....	213,507
1911	344,361	64	291	12,553	220,449	.....	233,293
1912	352,443	63	243	16,558	222,935	.....	239,736
1913	385,345	64	228	25,696	248,446	.....	274,370
1914	407,544	65	215	26,235	265,763	.....	292,213
1915	432,033	65	215	32,911	281,104	.....	314,230
1916	457,500	66	198	40,546	300,767	.....	341,511
1917	502,891	67	214	55,293	335,316	.....	390,823
1918	503,515	71	305	63,828	355,928	.....	420,061
1919	555,875	68	241	87,073	378,367	.....	465,681
1920	688,884	64	196	157,069	442,929	.....	600,194
1921	766,002	62	188	193,398	472,183	.....	665,769
1922	858,898	65	179	182,278	557,531	.....	739,988
1923	1,015,736	72	170	149,585	732,407	.....	882,162
1924	1,014,318	70	161	139,678	713,940	.....	853,779
1925	1,068,933	71	332	115,515	763,743	.....	879,590
1926	1,096,823	70	364	90,421	770,874	.....	861,659
1927	1,262,582	71	477	64,121	901,129	.....	965,727
1928	1,324,774	68	624	50,151	901,474	.....	952,249
1929	1,485,867	68	1,117	44,688	1,007,323	.....	1,053,128
1930	1,410,037	64	1,522	39,530	898,011	.....	939,063
1931	1,372,532	62	1,543	33,039	851,081	.....	885,663
1932	1,309,677	60	1,044	32,805	785,159	.....	819,008
1933	1,442,146	63	1,145	34,001	905,656	23	940,825
1934	1,522,288	60	1,417	38,172	908,065	28	947,682
1935	1,654,495	60	1,447	40,241	996,596	47	1,038,331
1936	1,791,546	61	1,500	41,028	1,099,687	62	1,142,277
1937	2,039,231	63	2,944	46,907	1,279,160	33	1,329,044
1938	1,988,041	61	6,966	38,506	1,214,355	78	1,259,905
1939	2,086,160	60.6	7,838	42,898	1,264,962	112	1,315,810
1940	2,149,821	62.9	8,591	44,036	1,353,214	142	1,405,983
1941	2,220,657	63.1	10,134	42,196	1,402,228	150	1,454,708
1942	2,093,100	66.2	10,365	34,815	1,386,645	151	1,431,976
1943	2,256,637	66.7	10,052	35,163	1,505,613	107	1,550,935
1944	2,592,289	64.7	10,099	38,203	1,677,904	109	1,726,315
1945	2,594,697	66.0	8,483	43,547	1,713,655	149	1,765,834
1946	2,745,430	63.2	7,586	49,235	1,733,939	269	1,791,029
1947	3,022,139	61.4	7,692	56,284	1,856,987	300	1,921,263
1948	3,433,225	58.8	12,287	58,508	2,020,185	159	2,091,139
1949	3,404,019	54.1	21,305	60,910	1,841,940	206	1,924,361
1950	3,803,027	51.9	29,044	72,443	1,973,574	156	2,075,217
1951	4,286,801	52.4	47,615	77,312	2,247,711	128	2,372,766
1952	4,508,954	50.8	61,237	77,275	2,289,836	36	2,428,384
1953	4,776,779	49.4	80,899	72,440	2,357,082	17	2,510,438
1954*	5,031,011	46.0	96,080	83,636	2,314,988	57	2,494,761
1955*	5,640,894	44.1	129,452	89,360	2,484,521	382	2,703,715
Total	89,802,321	58.6	606,762	2,882,377	52,613,226	2,901	56,105,266

South America, Since Beginning in 1896

YEAR	Argentina	Barbados	Bolivia	Brazil	Chile	Colombia	Ecuador	Peru	Trinidad	Venezuela	Total South America
1896	.....	.....	.....	.....	.....	.....	.....	47	.....	.....	47
1897	.....	.....	.....	.....	.....	.....	.....	71	.....	.....	71
1898	.....	.....	.....	.....	.....	.....	.....	71	.....	.....	71
1899	.....	.....	.....	.....	.....	.....	.....	89	.....	.....	89
1900	.....	.....	.....	.....	.....	.....	.....	274	.....	.....	274
1901	.....	.....	.....	.....	.....	.....	.....	275	.....	.....	275
1902	.....	.....	.....	.....	.....	.....	.....	287	.....	.....	287
1903	.....	.....	.....	.....	.....	.....	.....	278	.....	.....	278
1904	.....	.....	.....	.....	.....	.....	.....	290	.....	.....	290
1905	.....	.....	.....	.....	.....	.....	.....	373	.....	.....	373
1906	.....	.....	.....	.....	.....	.....	.....	531	.....	.....	531
1907	B	.....	.....	.....	.....	.....	.....	751	.....	.....	751
1908	12	.....	.....	.....	.....	.....	.....	945	B	.....	957
1909	18	.....	.....	.....	.....	.....	.....	1,411	57	.....	1,486
1910	20	.....	.....	.....	.....	.....	.....	1,258	143	.....	1,421
1911	13	.....	.....	.....	.....	.....	.....	1,465	285	.....	1,763
1912	47	.....	.....	.....	.....	.....	.....	1,752	437	.....	2,236
1913	131	.....	.....	.....	.....	.....	.....	2,071	504	.....	2,706
1914	276	.....	.....	.....	.....	.....	.....	1,837	644	.....	2,757
1915	513	.....	.....	.....	.....	.....	.....	2,579	750	.....	3,842
1916	867	.....	.....	.....	.....	.....	.....	2,593	929	.....	4,389
1917	1,218	.....	.....	.....	.....	.....	57	2,577	1,602	120	5,574
1918	1,353	.....	.....	.....	.....	.....	C60	2,527	2,082	333	6,355
1919	1,331	.....	.....	.....	.....	.....	C60	2,628	1,841	425	6,285
1920	1,651	.....	.....	.....	.....	.....	C60	2,817	2,083	457	7,068
1921	2,036	.....	.....	.....	.....	67	C60	3,699	2,354	1,433	9,649
1922	2,866	.....	.....	.....	.....	323	C60	5,314	2,445	2,201	13,209
1923	3,400	.....	.....	.....	.....	425	87	5,699	3,051	4,201	16,863
1924	4,639	.....	.....	.....	.....	445	C100	8,379	4,057	9,042	26,662
1925	6,336	.....	.....	.....	.....	1,007	160	9,232	4,387	19,687	40,809
1926	7,851	.....	.....	.....	.....	6,444	214	10,762	4,971	36,911	67,153
1927	8,630	.....	.....	.....	.....	15,014	537	10,127	5,380	63,134	102,822
1928	9,070	.....	.....	.....	.....	19,897	1,084	12,006	7,684	105,749	155,490
1929	9,391	.....	B	.....	.....	20,385	1,381	13,422	8,716	137,472	190,767
1930	9,002	.....	56	.....	.....	20,346	1,553	12,449	9,419	136,669	189,494
1931	11,709	.....	25	.....	.....	18,237	1,762	10,089	9,744	116,612	168,179
1932	13,139	.....	44	.....	.....	16,414	1,597	9,899	10,126	116,541	167,760
1933	13,691	.....	112	.....	.....	13,158	1,620	13,257	9,561	117,720	169,119
1934	14,024	.....	159	.....	.....	17,341	1,637	16,314	10,894	136,103	196,472
1935	14,297	.....	164	.....	.....	17,598	1,732	17,067	11,671	148,254	210,783
1936	15,458	.....	105	.....	.....	18,756	1,942	17,593	13,237	154,794	221,885
1937	16,355	.....	122	.....	.....	20,599	2,161	17,457	15,503	186,230	258,427
1938	17,076	.....	226	.....	.....	21,582	2,246	15,839	17,737	188,174	262,880
1939	18,613	.....	215	.....	.....	23,857	2,313	13,508	19,270	206,470	284,246
1940	20,609	.....	288	2	.....	25,593	2,349	12,126	22,227	185,570	268,764
1941	21,873	.....	235	3	.....	24,553	1,557	11,935	20,506	228,430	309,092
1942	23,704	2	308	33	.....	10,487	2,278	13,629	22,069	147,675	220,185
1943	27,714	2	334	48	.....	13,261	2,315	14,654	21,385	177,631	257,344
1944	24,230	1	314	58	.....	22,291	2,967	14,389	22,139	257,046	343,435
1945	22,881	2	382	79	.....	22,449	2,664	13,744	21,093	323,156	406,450
1946	20,604	1	363	67	.....	22,118	2,323	12,468	20,233	388,486	466,663
1947	21,846	B	377	97	.....	24,794	2,282	12,764	20,521	434,905	517,586
1948	23,734	.....	464	144	.....	23,792	2,563	14,069	20,111	490,015	574,892
1949	22,589	.....	678	109	.....	29,722	2,617	14,790	20,617	482,316	573,438
1950	23,353	.....	616	339	629	34,060	2,632	15,012	20,632	546,783	644,056
1951	24,465	.....	523	691	759	38,398	2,708	16,110	20,843	622,216	726,713
1952	24,825	.....	526	750	906	38,683	2,839	16,403	21,258	660,254	766,444
1953	28,501	.....	601	916	1,264	40,179	2,967	15,999	22,346	644,243	757,016
1954*	29,590	.....	1,695	992	1,736	39,621	3,146	17,162	23,628	692,294	809,864
1955*	30,457	.....	2,692	2,014	2,577	39,363	3,531	17,246	24,896	787,384	910,160
Total	596,008	8	11,624	6,342	7,871	701,259	64,221	484,409	526,068	8,957,137	11,354,947

*WORLD OIL from private sources. B Less than 1,000 barrels. C Estimated production.

World Crude Oil Production, By Countries, By Years (Part 2)

(Complete production history of world, in thousands of barrels of 42 U. S. Gallons. Sources: U. S. Bureau of Mines annual reports, *Mineral Resources and Minerals Yearbook*, and monthly reports, International Petroleum Trade and World Petroleum Statistics, except as otherwise indicated.)

Asia Since Beginning in 1875

	ASIA—Middle East									ASIA—Far East											
										[E]Burma-India Pakistan											
Year	Bahrain	Iran	Iraq	Kuwait	Neutral Zone	Qatar	Saudi Arabia	Turkey	Middle East Total	Burma	Pakistan	India	China	Indonesia	Japan	New Guinea	Sakhalin	Sarawak-Brunei	Formosa	Total Far East	[F]Total Asia
1874																					
1875															5					5	5
1876															7					7	7
1877															10					10	10
1878															18					18	18
1879															23					23	23
1880															26					26	26
1881															17					17	17
1882															15					15	15
1883															20					20	20
1884															28					28	28
1885															30					30	30
1886															38					38	37
1887															29					29	25
1888															37					37	30
1889											94				53					147	147
1890											118				52					170	170
1891											190				53					243	243
1892											242				69					311	311
1893											299			600	106					1,005	1,500
1894											327			688	173					1,188	1,188
1895											372			1,216	170					1,758	1,758
1896											430			1,427	237					2,094	2,094
1897											546			2,552	262					3,360	3,360
1898											542			2,964	319					3,825	3,825
1899											941			1,796	539					3,276	3,276
1900											1,079			2,253	871					4,203	4,203
1901											1,431			4,014	1,117					6,562	6,562
1902											1,617			2,430	996					5,043	5,043
1903											2,510			5,770	1,209					9,489	9,489
1904											3,385			6,508	1,219					11,112	11,112
1905											4,137			7,850	1,347					13,334	13,334
1906											4,016			8,181	1,564					13,761	13,761
1907											4,344			9,983	1,718					16,045	16,045
1908											5,047			10,283	1,871					17,201	17,201
1909											6,677			11,042	1,887					19,606	19,606
1910											6,138			11,031	1,829					18,998	18,998
1911											6,451			12,173	1,737					20,361	20,361
1912											7,117			10,846	1,659					19,622	19,622
1913		1,857							1,857		7,930			11,172	1,940			141		21,183	23,040
1914		2,910							2,910		7,410			11,422	2,636			318		21,786	24,696
1915		3,616							3,616		8,202			11,920	2,928			392		23,442	27,028
1916		4,477							4,477		8,491			12,547	2,963			629		24,630	29,107
1917		7,147							7,147		8,079			13,180	2,861			542		24,662	31,809
1918		8,623							8,623		8,188			12,778	2,441			504		23,911	32,534
1919		10,139							10,139		8,736			15,508	2,238			596		27,078	37,217
1920		12,230							12,230		8,375			17,529	2,221			1,020		29,145	41,375
1921		16,673							16,673		8,734			16,958	2,233		2	1,411		29,338	46,011
1922		22,247							22,247		8,529			17,066	2,055		7	2,849		30,506	52,753
1923		25,230							25,230		8,406			19,870	1,804		9	3,940		34,029	59,259
1924		32,373							32,373		8,416			20,473	1,814		80	4,163		34,946	67,319
1925		35,038							35,038		8,274			21,422	1,915		87	4,257		35,955	70,993
1926		35,842							35,842		8,011			21,243	1,785		181	4,942		36,162	72,004
1927		39,688	338						40,026		8,032			27,459	1,789		440	4,943		42,663	82,689
1928		43,461	713						44,174		8,741			32,118	1,944		677	[G]5,223		48,703	92,877
1929		42,145	798						42,943		8,747			39,279	2,023		[D]1,134	5,290		56,473	99,416
1930		45,828	913						46,741		8,292			41,729	1,950		[D]1,805	4,907		58,683	105,424
1931		44,376	830						45,206		8,200			35,539	2,050		2,734	3,854		52,377	97,583
1932		49,471	836						50,307		8,817			39,001	1,630		2,631	3,796		55,875	106,182
1933	31	54,392	917						55,340		8,743			42,606	1,455		2,338	4,490		59,632	114,972
1934	285	57,851	7,689						65,825		10,503			46,925	1,834		2,881	5,140		67,283	133,108
1935	1,265	57,273	27,408						85,946	7,181	[E]	2,038		47,171	2,249		2,545	5,546		66,730	152,676
1936	4,645	62,718	30,406				20		97,789	7,588	[E]	1,978		50,025	2,440		3,212	5,209		70,452	168,241
1937	7,762	77,804	31,836				65		117,467	7,848	[E]	2,162		56,724	2,488		3,656	6,009		78,887	196,354
1938	8,298	78,372	32,643				495		119,808	7,538	[E]	2,488		57,318	2,511		[C]3,821	6,913		80,589	200,397
1939	7,589	78,151	30,791				3,934		120,465	7,873	[E]	2,327	4	62,087	2,654		4,900	7,097		86,042	206,507
1940	7,074	66,317	24,225				5,075		102,691	7,731	[E]	2,302	10	62,011	2,639		4,000	7,047		85,740	188,431
1941	6,794	50,777	12,650				4,310		74,531	7,762	[E]	2,899	87	53,704	1,929		4,000	6,864	62	77,307	151,838
1942	6,241	72,256	19,726				4,530		102,753	2,500	[E]	2,792	340	24,000	1,652		4,000	3,000	48	38,332	141,085
1943	6,572	74,612	24,848				4,868		110,900	1,000	[E]	2,735	447	48,294	1,727		5,000	4,500	38	63,741	174,641
1944	6,714	102,045	30,943				7,794		147,496	750	[E]	2,784	505	22,260	1,601		5,000	6,000	40	38,940	186,436
1945	7,309	130,526	35,112				21,311		194,258	725	[E]	2,363	484	7,600	1,544		6,000	2,100	14	20,830	215,088
1946	8,010	146,819	35,665	5,931			59,944		256,369	15	[E]	2,193	513	2,100	1,343		6,000	2,050	18	14,230	270,599
1947	9,411	154,998	35,834	16,225			89,852		306,320	59	356	1,863	374	8,020	1,276		[C]7,000	12,970	22	31,940	338,260
1948	10,915	190,384	26,115	46,500			142,853	13	416,780	341	490	1,875	533	31,765	1,122	135	7,000	20,124	23	63,408	480,188
1949	10,985	204,712	30,957	90,000		750	174,008	95	511,507	248	824	1,906	730	43,206	1,353	1,726	7,000	25,108	22	82,123	593,630
1950	11,016	242,475	49,726	125,722		12,268	199,547	108	640,862	532	1,281	1,867	800	48,400	2,066	1,748	7,000	30,958	23	94,675	735,537
1951	10,994	127,600	65,122	204,910		18,009	277,963	133	704,731	858	1,348	1,949	900	55,453	2,337	1,746	7,000	37,506	21	109,118	813,849
1952	11,004	10,100	141,100	273,433		25,255	301,861	146	762,899	942	1,580	1,900	1,000	62,495	2,134	1,725	7,000	38,251	18	117,045	879,944
1953	10,978	9,400	210,268	314,592		31,025	308,294	179	884,736	1,073	1,762	2,215	1,500	75,148	2,101	1,751	7,000	36,848	17	129,415	1,014,151
1954*	10,991	21,316	228,468	347,557	5,991	36,732	347,845	413	999,313	1,550	1,948	2,235	11,000	80,300	2,157	4,370	7,000	36,326	35	146,921	1,146,234
1955*	10,982	120,137	246,479	398,494	8,848	41,088	352,240	1,199	1,180,187	1,618	2,068	2,526	13,200	85,921	2,229	3,418	7,300	39,351	24	157,655	1,337,842
Total	175,865	2,674,406	1,383,356	1,823,364	14,839	165,847	2,306,809	2,286	8,546,772		368,692		32,427	1,625,353	109,421	16,619	129,540	403,124	423	2,685,599	11,232,371

[B] Less than 1,000 barrels. [C] Estimated production [D] Year ended September 30. [E] Separation of British India and Burma prior to 1935 not available from U.S. Bureau of Mines data used here. Data by Dudley Stamp in "Petroleum Development and Technology, 1933" and in A.I.M.E. "Transactions" indicate cumulative through 1934 as follows: Burma 184,528, India 20,756. Pakistan included with India prior to 1947. [F] Exclusive of U.S.S.R. fields in Asia, other than Sakhalin, which are included with U.S.S.R. in Europe. [G] Beginning of production in Brunei. [H] Formosa included with Japan prior to 1941. * WORLD OIL from private sources.

World Crude Oil Production, By Countries, By Years (Part 3)

(Complete production history of world, in thousands of barrels of 42 U. S. Gallons. Sources: U. S. Bureau of Mines annual reports, *Mineral Resources and Minerals Yearbook*, and monthly reports, International Petroleum Trade and World Petroleum Statistics, except as otherwise indicated.)

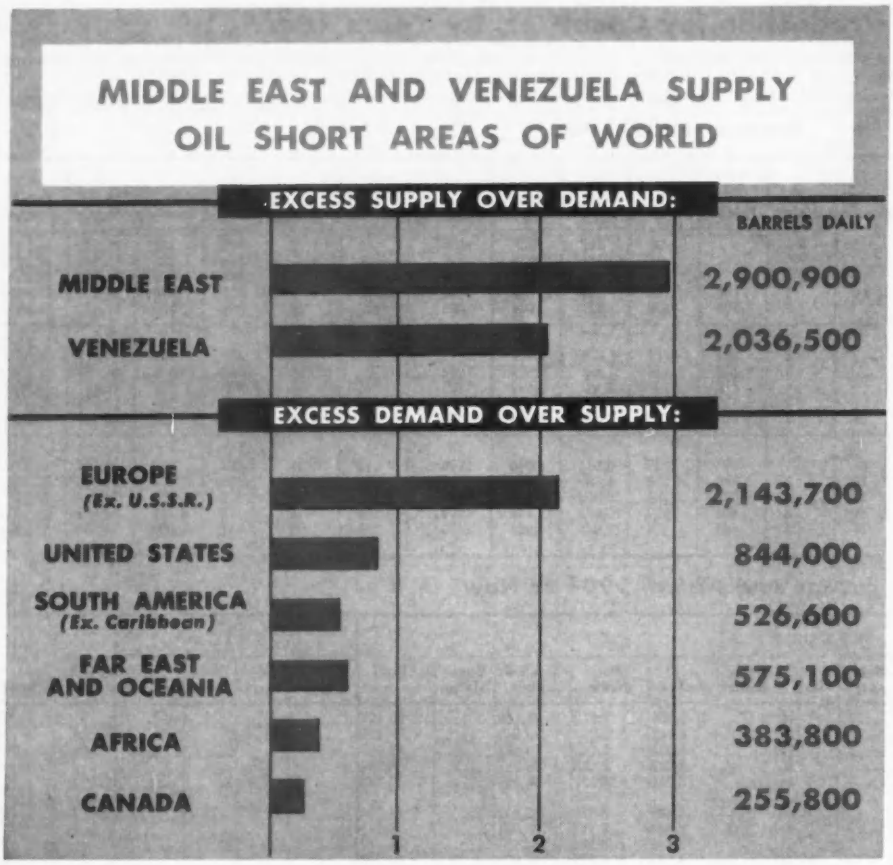
Europe, 1857-1900

YEAR	Italy	Rumania	[F] U.S.S.R. (Russia)	[F] Total Europe	YEAR	Germany	Italy	Poland	Rumania	[F] U.S.S.R. (Russia)	[F] Total Europe	YEAR	Germany	Italy	Poland	Rumania	[F] U.S.S.R. (Russia)	[F] Total Europe
1856	....	....	....	....	1871	....	[B]	....	90	165	255	1886	74	2	306	168	18,006	18,556
1857	....	2	....	2	1872	....	[B]	....	91	185	276	1887	74	1	344	182	18,368	18,969
1858	....	4	....	4	1873	....	[B]	....	104	475	579	1888	85	1	467	219	23,049	23,831
1859	....	4	....	4	1874	....	1	150	103	583	837	1889	68	1	515	298	24,609	25,491
1860	....	9	....	9	1875	....	1	158	108	697	964	1890	108	3	659	383	28,691	29,844
1861	[B]	17	....	17	1876	....	3	164	111	1,321	1,599	1891	109	8	631	488	34,573	35,809
1862	[B]	23	....	23	1877	....	3	170	108	1,801	2,082	1892	101	18	646	593	35,775	37,133
1863	[B]	28	41	69	1878	....	4	176	109	2,401	2,690	1893	100	19	693	535	40,457	41,804
1864	[B]	33	65	98	1879	....	3	215	110	2,761	3,089	1894	123	21	949	508	36,375	37,976
1865	2	39	67	108	1880	9	2	229	115	3,001	3,356	1895	121	26	1,453	576	46,140	48,316
1866	1	42	83	126	1881	29	1	287	122	3,601	4,040	1896	145	18	2,444	543	47,221	50,371
1867	1	51	120	172	1882	58	2	330	136	4,538	5,064	1897	166	14	2,226	571	54,399	57,376
1868	[B]	56	88	144	1883	27	2	365	139	6,002	6,535	1898	184	15	2,376	776	61,610	64,961
1869	[B]	59	202	261	1884	46	3	408	211	10,805	11,473	1899	192	16	2,314	1,426	65,955	69,903
1870	[B]	84	204	288	1885	41	2	465	193	13,925	14,626	1900	358	12	2,347	1,629	75,780	80,126

Europe and Africa, 1901 to Now

	EUROPE													AFRICA					
YEAR	Albania	Austria	Czecho-slovakia	Great Britain	France	Ger-many	Hun-gary	Italy	Nether-lands	Poland	Ru-mania	[F]U.S.S.R. (Russia)	Yugo-slavia	[F]Total Europe	Egypt	Al-geria	Mo-rocco	Total Africa	Austra-lia-N. Zealand	Rest of World
1901						314		16		3,251	1,678	85,168		90,427						20
1902						354		19		4,142	2,060	80,540		87,115						26
1903						446		18		5,235	2,763	75,591		84,053						36
1904						687		26		5,947	3,599	78,537		88,746						40
1905						561		44		5,766	4,421	54,960		65,752						30
1906						579		54		5,468	6,378	58,897		71,376						30
1907						757		60		8,456	8,118	61,851		79,242						30
1908						1,009		51		12,612	8,252	62,187		84,111						30
1909						1,019		42		14,933	9,327	65,970		91,291						30
1910						1,032		51		12,673	9,724	70,337		93,817						30
1911						1,017		75		10,519	11,108	66,184		88,903	21			21		30
1912						1,031		54		8,535	12,976	68,019		90,615	214			214		30
1913						857		47		7,818	13,555	62,834		85,111	98			98		30
1914						781		40		6,436	12,827	67,020		87,104	753	1		754		30
1915						703		44		5,352	12,030	68,548		86,677	212	4		216		10
1916						656		51		6,587	8,945	65,817		82,056	404	8		412		25
1917					[G]	642		41		6,228	3,721	63,072		73,704	943	9		952		28
1918					363	270		35		6,032	8,730	27,168		42,598	1,935	7		1,942		25
1919			48	2	334	265		35		6,096	6,618	31,752		45,150	1,517	5		1,522		20
1920			69	3	356	246		35		5,607	7,435	25,430		39,181	1,042	4		1,046		20
1921			94	3	389	274		32		5,167	8,368	28,968		43,295	1,255	3		1,258		20
1922			120	1	496	319		31		5,227	9,843	35,692		51,729	1,188	9		1,197		22
1923			74	1	494	346		34		5,402	10,867	39,147		56,365	1,054	9		1,063		24
1924			76	2	497	406		29		5,657	13,369	45,355		65,401	1,122	11		1,133		24
1925			158	3	459	541		61		5,960	16,650	52,448		76,280	1,226	12		1,238		23
1926			150	2	478	653		41		5,844	23,314	64,311		94,793	1,188	9		1,197		17
1927			112	2	504	663		47		5,342	26,368	77,018		110,056	1,267	8		1,275		13
1928			94	1	512	630		46		5,492	30,773	[D]84,745		122,293	1,842	8		1,850		15
1929			93		535	704		45		4,988	34,758	[D]99,507		140,630	1,868	20		1,888		38
1930			157	[B]	523	1,182		59		4,904	41,624	[D]125,555		174,004	1,996	16		2,012		40
1931			134	[E]	520	1,606		124		4,662	49,127	162,842		219,015	2,038	[E]		2,038		54
1932			126	[E]	530	1,608		208		4,116	53,815	154,367		214,770	1,895	[E]	7	1,902		62
1933	11		122	[E]	562	1,665		204		4,072	54,020	154,840		215,496	1,663	[E]	7	1,670		71
1934	10		178	[E]	557	2,187		151		3,913	62,063	174,318		243,377	1,546	[E]	6	1,552		98
1935	41	44	133	[E]	541	2,996		119		3,812	61,310	182,386	2	251,394	1,301	[E]	4	1,305	5	4
1936	273	50	127	[E]	503	3,115		123		3,789	63,659	186,206	1	257,846	1,278	[E]	4	1,282	5	4
1937	619	221	123	[E]	502	3,176	16	110		3,716	52,452	193,241	4	254,180	1,196	[E]	22	1,218	4	4
1938	752	383	130	[E]	513	3,861	288	101		3,763	48,487	204,956	9	263,243	1,581	[E]	27	1,608	4	4
1939	934	1,240	120		500	4,487	1,103	91		3,898	45,648	216,866	10	274,897	4,666	[E]	27	4,693	3	4
1940	1,497	2,808	163	124	496	7,371	1,881	85		3,891	43,168	218,600	10	280,094	6,505	[E]	27	6,532	3	14
1941	1,334	4,238	183	223	414	6,303	3,183	95		1,793	40,517	238,150	10	296,443	8,546	[E]	27	8,573	3	
1942	1,601	5,899	271	605	463	5,191	5,037	101		2,794	42,094	227,470	10	291,536	8,275	[E]	41	8,316	2	
1943	1,001	7,478	209	839	356	4,973	6,347	86	1	3,500	39,182	200,750	10	264,723	8,953		39	8,992	2	
1944	324	8,218	185	703	300	6,154	6,277	55	12	3,000	26,191	275,000	220	326,649	9,416	4	32	9,452	2	
1945	367	2,074	91	532	202	3,935	5,018	53	41	750	34,772	148,953	200	197,888	9,406	2	26	9,434	3	
1946	1,000	5,734	196	413	368	4,539	5,146	83	435	866	31,434	157,673	160	208,046	9,070	1	20	9,091	2	
1947	2,000	6,285	210	351	356	4,032	4,330	81	1,478	951	28,552	187,463	290	236,379	8,627	1	21	8,649	2	
1948	1,500	5,149	204	323	369	4,489	3,647	71	3,443	1,039	34,000	218,000	270	273,504	13,398	1	100	13,499	3	
1949	2,188	6,100	292	338	411	5,947	3,791	71	4,314	1,125	33,700	237,700	470	296,447	15,997	2	136	16,135	8	
1950	2,800	10,200	292	340	909	8,107	3,700	63	4,897	1,205	32,000	266,200	794	331,507	16,373	24	305	16,702	8	
1951	1,200	15,477	644	335	2,036	9,681	3,500	135	4,942	1,502	31,000	285,000	1,067	356,519	16,311	49	587	16,947	7	
1952	1,100	20,400	740	407	2,377	12,435	3,500	487	4,975	1,700	45,000	322,400	1,091	416,612	16,464	348	749	17,561	9	
1953	1,400	21,100	900	410	2,555	15,505	5,000	656	5,701	1,800	52,000	363,000	1,236	471,263	16,501	641	761	17,903	8	
1954*	1,560	23,079	947	435	3,591	18,930	8,362	889	6,526	1,910	74,350	422,881	1,465	564,925	13,760	575	884	15,219	8	
1955*	1,871	24,886	1,117	394	6,409	22,345	10,970	2,536	7,137	2,800	78,588	514,433	1,736	675,222	12,740	434	758	13,932	23	
Total	25,293	173,063	9,073	6,791	32,280	185,750	81,096	8,257	43,902	289,530	1,538,524	8,470,462	9,065	10,873,086	228,651	2,225	4,617	235,493	114	1,044

[B] Less than 1,000 barrels. [C] Estimated production. [D] Year ended September 30. [E] No more data available. [F] Includes fields in Russian Asia other than Sakhalin.
[G] France's earlier production credited to Germany. * WORLD OIL from private sources.



World Supply and Demand . . .

Total supply more than doubles in 10 years.

THE KEY FACTORS in world supply keeping up with rapidly rising demand during recent years have been Venezuela and the Middle East—the only large surplus producing areas in the world.

Production from these two areas helped make it possible for world consumption to reach 16,069,000 barrels per day in 1955, 1⅔ million barrels more than in 1954—and more than twice the 7,777,900 barrels of oil consumed daily throughout the world in 1946.

Total world supply of crude oil and natural gas liquids also have more than doubled in the past ten years. Production has increased from 7,926,700 barrels per day in 1946 to 16,268,300 barrels per day last year. Total world production in 1955 was 1,701,700 barrels per day more than the total in 1954.

Despite the rapid increase in consumption, excess of supply over demand totaled 199,300 barrels per day last year, compared with 112,600 barrels per day in 1954—and 148,800 barrels per day in 1946.

Venezuela and the Middle East alone produced 5,414,300 barrels of oil per day during 1955 (Venezuela, 2,163,900; Middle East, 3,250,400), while consuming only 476,900 barrels per day (Venezuela, 127,400; Middle East, 349,500). This excess of 4,937,400 barrels of daily production accounted for 30.3 percent of the world's oil supply last year. This compared with 1946 when surplus production from the two areas totaled only 19.9 percent of the total supply.

Venezuela produced 2 million barrels of oil per day more than it consumed last year—double its surplus of 1 million barrels daily in 1946. The Middle East produced almost 3 million more barrels of oil per day than it consumed in 1955—for a total increase of 5½ times its 1946 production of 545,000 barrels daily. The Middle East's surplus production totaled 17.8 percent of the world supply last year, compared with 6.8 percent in 1946.

Europe Biggest Shortage Area. On the debit side, Europe (excluding the USSR) and North America are the two major oil short areas of the world.

The ten-year trend toward increased demand over supply for both areas hit a new peak in 1955, i.e., Europe consumed 2,143,700 barrels of oil per day (13.4 percent) more than it produced. North America's consumption rate was 1,130,000 barrels per day (7.6 percent) over the total supply. This is a sharp increase over 1946 when North America consumed only 124,900 barrels per day (2.9 percent) more than it produced—and Europe consumed 625,700 barrels per day (8.1 percent) more than its supply.

Since 1946, the U. S. supply-demand ratio has shown a most marked change. The U. S. has reversed from a surplus producer to a decided surplus consumer.

Last year the U. S. produced 7,532,000 barrels of oil per day. At the same

Demand for All Oils Met by U. S. Petroleum Industry
(THOUSAND BARRELS DAILY)

Item	1954	1955 Amount	1955 % Diff.	1956 Amount	1956 % Diff.
FIRST HALF OF YEAR					
Total Demand	**8,091**	**8,696**	**+ 7.5**	**9,206**	**+ 5.9**
Exports	362	360	— 0.6	329	— 8.6
Domestic Demand	7,729	8,336	+ 7.9	8,877	+ 6.5
SECOND HALF OF YEAR					
Total Demand	**8,139**	**8,864**	+ 8.9	**9,305**	**+ 5.0**
Exports	348	370	+ 6.3	342	— 7.6
Domestic Demand	7,791	8,494	+ 9.0	8,963	+ 5.5
WHOLE YEAR					
Total Demand	**8,115**	**8,781**	+ 8.2	**9,256**	**+ 5.4**
Exports	355	366	+ 3.1	336	— 8.2
Domestic Demand	7,760	8,415	+ 8.4	8,920	+ 6.0

World Petroleum Demand and Supply, by Regions, for Years 1955, 1954 and 1946

Source: All data from private sources. Crude oil production figures may differ slightly from those in other tables in this issue, which are from U. S. Bureau of Mines and other sources; but such differences are inconsequential

Barrels Per Day

REGION	Domestic Demand	DOMESTIC SUPPLY			Excess Supply Over Demand	Excess Demand Over Supply	Percent of World	
		Crude Oil	Natural Gasoline, Etc.	Total			Domestic Demand	Domestic Supply
1955								
North America	9,276,900	7,406,600	740,100	8,146,700	.....	1,130,200	57.7	50.1
United States	8,416,000	6,807,000	725,000	7,532,000	.....	884,000	52.4	46.3
Canada	621,000	354,700	10,500	365,200	.....	255,800	3.8	2.3
Other North America	239,900	244,900	4,600	249,500	9,600	.....	1.5	1.5
South America	1,006,900	2,494,500	21,600	2,516,100	1,509,200	.....	6.3	15.5
Venezuela	127,400	2,157,900	6,000	2,163,900	2,036,500	.....	0.8	13.3
Other Caribbean Area	183,000	175,900	6,400	182,300	.....	700	1.2	1.1
Other South America	696,500	160,700	9,200	169,900	.....	526,600	4.3	1.1
Europe Excl. U.S.S.R.	2,670,800	430,700	96,400	527,100	.....	2,143,700	16.6	3.2
U.S.S.R.	1,368,000	1,340,000	50,000	1,390,000	22,000	.....	8.5	8.5
Africa	425,900	38,100	4,000	42,100	.....	383,800	2.7	0.3
Middle East	349,500	3,250,400	.....	3,250,400	2,900,900	.....	2.2	20.0
Far East, Oceania	971,000	390,900	5,000	395,900	.....	575,100	6.0	2.4
Total World	16,069,000	15,351,200	917,100	16,268,300	199,300	.....	100.0	100.0
1954								
North America	8,538,500	6,834,800	700,400	7,535,200	.....	1,003,300	59.1	51.7
United States	7,760,000	6,342,400	692,000	7,034,400	.....	725,600	53.7	48.3
Canada	558,900	263,200	4,200	267,400	.....	291,500	3.9	1.8
Other North America	219,600	229,200	4,200	233,400	13,800	.....	1.5	1.6
South America	913,700	2,218,400	21,600	2,240,000	1,326,300	.....	6.3	15.4
Venezuela	107,100	1,896,300	5,400	1,901,700	1,794,600	.....	0.7	13.1
Other Caribbean Area	175,400	173,400	8,000	181,400	6,000	.....	1.2	1.2
Other South America	631,200	148,700	8,200	156,900	.....	474,300	4.4	1.1
Europe Excl. U.S.S.R.	2,278,400	375,800	83,000	458,800	.....	1,819,600	15.7	3.2
U.S.S.R.	1,181,000	1,137,000	48,000	1,185,000	4,000	.....	8.2	8.1
Africa	387,100	41,700	2,400	44,100	.....	343,000	2.7	0.3
Middle East	288,000	2,740,700	.....	2,740,700	2,452,700	.....	2.0	18.8
Far East, Oceania	867,300	357,800	5,000	362 800	.....	504 500	6.0	2.5
Total World	14,454,000	13,706,200	860,400	14,566,600	112,600	.....	100.0	100.0
1946								
North America	5,352,000	4,906,900	320,200	5,227,100	.....	124,900	68.8	65.9
United States	4,912,000	4,750,500	317,000	5,067,500	155,500	.....	63.2	63.9
Canada	221,500	21,000	1,200	22,200	.....	199,300	2.8	0.3
Other North America	218,500	135,400	2,000	137,400	.....	81,100	2.8	1.7
South America	377,200	1,275,700	7,600	1,283,300	906,100	.....	4.8	16.2
Venezuela	24,400	1,064,300	500	1,064,800	1,040,400	.....	0.3	13.4
Other Caribbean Area	129,200	113,200	3,800	117,000	.....	12,200	1.6	1.5
Other South America	223,600	98,200	3,300	101,500	.....	121,100	2.9	1.3
Europe Excl. U.S.S.R.	808,300	136,400	46,200	182,600	.....	625,700	10.4	2.3
U.S.S.R.	514,700	438,200	9,000	447,200	.....	67,500	6.6	5.7
Africa	160,000	24,500	.....	24,500	.....	135,500	2.1	0.3
Middle East	145,000	690,400	.....	690,400	545,400	.....	1.9	8.7
Far East, Oceania	420,700	67,400	4,200	71,600	.....	349,100	5.4	0.9
Total World	7,777,900	7,539,500	387,200	7,926,700	148,800	.....	100.0	100.0

time it was consuming oil at a daily rate of 8,416,000 barrels per day—for an excess daily consumption rate of 884,000 barrels (6.1 percent) over domestic supply. This compares with an excess consumption of 725,600 barrels per day (5.4 percent) over supply in 1954.

In contrast, the U. S. produced 155,500 barrels per day (0.7 percent) more than it consumed in 1946.

Due to rapid growth elsewhere, the U. S. is accounting for a smaller portion of the world's oil consumption and supply every year. In 1946, the U. S. used 63.2 percent of the world's consumption. Although showing big gains in consumption, the U. S. in 1955 used but 52.4 percent of total world demand—10.8 percent less than in 1946.

U. S. supremacy in world production has decreased at an even faster rate.

World Producing Wells . . . total 580,356 at end of 1955.

TOTAL FREE WORLD producing oil wells numbered 580,356 at the close of 1955, up 25,486 wells from the previous year for a 4.6 percent increase. The revised total amounted to 554,870 producers at year's end of 1954. Daily production reflected an expected accompanying upturn of 1,791,080 barrels, or 14.6 percent from than the 12,247,685 total for the end of 1954.

Thus, 1955's year-end crude output of 14,038,765 barrels accounted for an average yield per well of 24.2 barrels per day.

It would be understandably difficult to obtain a complete and accurate accounting of the number and status of all free world producing oil wells for any given period, even with full cooperation of all governments and producing oil companies throughout the world. In the absence of definite government or company reports from several areas covering complete operations, WORLD OIL has used actual figures from private sources as bases for estimates.

United States. For the third consecutive year, the U. S. accounted for more than a half million producing wells at year's end. Its 537,682 producers compared with 514,808 in 1954, and resulted in total production of 6,832,200 barrels per day for an average daily output of 12.7 barrels of oil.

Canada. The continuing Western Canadian drilling program resulted in a total of 8759 producing wells for the country at the close of 1955, as compared with 7181 at the same period of the previous year. Daily average crude yield per well of 46.2 barrels accounted for total daily average production of 404,480 barrels at year's end. At the close of 1954 daily production of 263,315 barrels was tantamount to the production of slightly more than 36 barrels per day per well.

Middle East. This area of major world reserves also is an area of major world crude production. With 625 producing wells at the close of 1955, 58 more than recorded at the same period of the previous year, and total daily production averaging 3,316,135 barrels, 578,320 barrels more than at the close of 1954, the daily average production per well amounted to 5305 barrels. That was 477 barrels a day per well more than the comparable figure for 1954.

It was this large barrel-per-well total which boosted the total free world, outside U. S., record for the year 1955.

World Producing Oil Wells

(Excluding U.S.S.R. and Satellites)

COUNTRY	END 1954 Wells	END 1954 Daily Prod.	END 1955 Wells	END 1955 Daily Prod.	END 1955 Barrels per Well
North America Excl. U.S.	**8,732**	**500,830**	**10,311**	**651,030**	**53.4**
Canada	7,181	263,315	8,759	404,480	46.2
Cuba	35	155	39	1,050	26.9
Mexico	1,516	237,360	1,513	245,500	162.3
South America	**19,365**	**2,217,390**	**19,951**	**2,644,005**	**132.5**
Argentina	*750	81,065	*845	84,450	100.0
Bolivia	54	4,645	54	8,550	158.3
Brazil	263	2,720	296	6,830	23.1
Chile	66	4,755	42	7,260	172.9
Colombia	1,707	108,545	1,809	119,900	66.3
Ecuador	1,452	8,620	1,457	9,750	6.7
Peru	3,227	47,020	3,056	47,275	15.5
Trinidad	2,632	64,735	2,780	68,200	24.5
Venezuela	9,214	1,895,285	9,612	2,291,790	238.4
Western Europe	**4,490**	**146,230**	**4,737**	**174,380**	**36.8**
Austria	688	63,230	802	68,180	85.0
France	476	9,640	*557	17,400	31.2
Germany, West	2,781	51,865	2,808	61,220	21.8
Great Britain	222	1,190	224	1,080	4.8
Italy and Sicily	*55	2,435	*63	6,950	110.3
Netherlands	268	17,870	283	19,550	69.1
Africa	**285**	**41,695**	**296**	**38,575**	**130.3**
Algeria	43	1,575	38	1,050	27.6
Egypt	149	37,700	*161	35,450	220.2
Morocco	93	2,420	97	2,075	21.4
Middle East	**567**	**2,737,815**	**625**	**3,316,135**	**5,305.0**
Bahrain Islands	94	30,110	106	30,100	284.0
Iran	*45	58,400	39	400,000	10,255.0
Iraq	72	625,935	60	678,195	11,300.0
Israel			1	240	240.0
Kuwait	163	952,200	185	1,100,000	5,945.0
Neutral Zone	16	16,415	29	24,250	835.0
Qatar	26	100,635	32	115,000	3,595.0
Saudi Arabia	141	952,990	154	965,000	6,265.0
Turkey	10	1,130	19	3,350	176.0
Far East	**6,618**	**353,200**	**6,748**	**382,375**	**56.7**
Burma	*80	4,245	*86	4,475	52.0
Taiwan (Formosa)	27	95	28	65	2.3
India	*600	6,125	*593	6,920	11.7
Indonesia	1,927	220,000	*1,960	235,750	120.3
Japan	3,530	5,910	3,512	6,100	1.7
New Guinea	47	11,970	51	9,250	181.4
Pakistan	n.a.	5,335	*90	5,700	63.3
Sarawak-Brunei (Br. Borneo)	407	99,520	*428	114,115	266.6
Australia-New Zealand	5	25	6	65	10.8
Total Free World Outside U.S.	**40,062**	**5,997,185**	**42,674**	**7,206,565**	**168.9**
United States	**514,808**	**6,250,500**	**537,682**	**6,832,200**	**12.7**
Total Free World	**554,870**	**12,247,685**	**580,356**	**14,038,765**	**24.2**

* Estimate. n.a.—Not Available.

World's Deepest Wells . . .

Almost half in 9000-11,000 foot range.

RECORD DRILLING depths for countries throughout the world range from 22,570 feet in the U. S. to only 1995 feet in New Caledonia. Drilling depth figures from 76 reporting countries show that between these extremes almost 50 percent are to be found in the 9000-foot, 10,000-foot and 11,000-foot range.

As might be expected, second to the U. S. is Venezuela, whose deepest well was 17,537 feet. Russia, with a recorded 17,060-foot drilling effort, followed. Only one country reported that its drilling record fell into the 16,000-foot range, and that was Trinidad. There, the domestic record depth stood at 16,115 feet.

Colombia and Australia were next in line with wells which reached 15,539 feet and 15,188 feet, respectively.

The 14,000-foot group included six countries from the North American continent, Africa, Europe, South America, Middle East, and Far East. Saudi Arabia led in this range, with a 14,875-foot well, followed in order by Argentina, with a well drilled to 14,764 feet; Canada, 14,696 feet; Algeria, 14,503 feet; Papua, 14,325 feet; and France, with a 14,275-foot test.

The 13,000-foot range included seven countries, one more than the previous group, representing five geographic areas—Africa, Middle East, South America, Europe, and the Far East. In order of position, they were: Morocco, with a recorded test which was drilled to a total depth of 13,971 feet; Kuwait, which followed closely with its deepest-well report of 13,853 feet; Ecuador, with a 13,264-foot well; Rumania, 13,123 feet; India, 13,060 feet; Trucial Coast, 13,001; and Egypt, with an even 13,000-foot well.

The 12,000-foot range included two countries in Africa, two in Europe, and one each in the Far East, South America, and the North American continent. The deepest of this range was drilled in Tunisia to a depth of 12,820 feet. Following Tunisia, in order, were West Germany, 12,726 feet; Pakistan, 12,666 feet; Peru, 12,530 feet; Mexico, 12,513 feet; The Netherlands, 12,458 feet; and Nigeria, with an even 12,000-foot well.

Middle Eastern and African countries accounted for almost 50 percent of the 11,000-foot range in which position appeared wells in 17 areas. Bahrain Island barely missed the 12,000-foot category with its deepest well, which was drilled to a total depth of 11,985 feet. Hard upon Bahrain's heels came Israel and its 11,958-foot effort. The following 15 countries appeared on the deep well record list:

Alaska, 11,872 feet; Dhofar, 11,776 feet; Taiwan, 11,756 feet; Turkey, 11,616 feet; Bulgaria, 11,483 feet; Denmark, 11,356 feet; Barbados, 11,352 feet; Cuba, 11,218 feet; French Equatorial Africa, 11,212 feet; Spain, 11,205 feet.

Iran, 11,190 feet; Ethiopia, 11,161 feet; French West Africa, 11,153 feet; Brazil, 11,083 feet; and Tanganyika, 11,051 feet.

Record depths at the 10,000-foot and 9000-foot level were recorded by 20 countries. Heading the list in the 10,000-foot category was Italy, with a record for its own drilling of 10,800 feet; British Borneo, whose deepest well was drilled to 10,780 feet; Chile, 10,753 feet; Japan, 10,505 feet; Hungary 10,499 feet; Mozambique, 10,455 feet; Syria, 10,163 feet; Costa Rica, 10,128 feet; Saudi Arabia-Kuwait Neutral Zone, 10,005 feet; and Iraq, with a 10,000-foot well.

A non-oil producing area held the No. 1 position in the 9000-foot level—Philippines, where the deepest well was drilled to 9950 feet. Austria's deepest well reached to 9711 feet, followed by Burma, whose deepest effort reached 9705 feet; Yugoslavia, 9580 feet; Madagascar, 9290 feet; Greece, 9259 feet; Sicily, 9150 feet; Haiti, 9010 feet; Cameroon, 9005 feet; and Honduras, where the deepest well yet drilled was to 9000 feet.

Only one country—Lebanon—reported that its deepest well was in the 8000-foot range. There, the domestic record was 8767 feet.

Six countries put themselves in the 7000-foot category of deepest wells drilled yet in each: Great Britain, with its deepest well drilled to 7680 feet; Indonesia, 7388 feet; New Guinea, 7311 feet; Switzerland, 7105 feet; Angola, 7057 feet; and Portugal, 7009 feet.

The deepest well ever drilled in Eastern Germany was to 6562 feet, and Jamaica reported 6314 feet.

Sumatra recorded a 5542-foot well as its record; Bolivia reported its deepest test was drilled to 5329 feet. The record depth well in Cyprus was drilled to 4500 feet even. And New Caledonia, in the Far East, reported a relatively shallow 1995-foot well as the deepest test yet drilled there.

Record Drilling Depths by Countries

Depth	Country	Depth	Country	Depth	Country	Depth	Country
22,570	United States	12,820	Tunisia	11,190	Iran	9290	Madagascar
17,537	Venezuela	12,726	Germany, West	11,161	Ethiopia	9259	Greece
17,060	Russia	12,666	Pakistan	11,153	French West Africa	9150	Sicily
16,115	Trinidad	12,530	Peru	11,083	Brazil	9010	Haiti
15,539	Colombia	12,513	Mexico	11,051	Tanganyika	9005	Cameroon
15,188	Australia	12,458	Netherland	10,800	Italy	9000	Honduras
14,875	Saudi Arabia	12,000	Nigeria	10,780	British Borneo	8767	Lebanon
14,764	Argentina	11,985	Bahrain Island	10,753	Chile	7680	Great Britain
14,696	Canada	11,958	Israel	10,505	Japan	7388	Indonesia
14,503	Algeria	11,872	Alaska	10,499	Hungary	7311	New Guinea
14,325	Papua	11,776	Dhofar	10,455	Mozambique	7105	Switzerland
14,275	France	11,756	Taiwan	10,163	Syria	7057	Angola
13,971	Morocco	11,616	Turkey	10,128	Costa Rica	7009	Portugal
13,853	Kuwait	11,483	Bulgaria	10,005	Neutral Zone	6562	Germany, East
13,264	Ecuador	11,356	Denmark	10,000	Iraq	6314	Jamaica
13,123	Rumania	11,352	Barbados	9,950	Philippines	5542	Sumatra
13,060	India	11,218	Cuba	9,711	Austria	5329	Bolivia
13,001	Trucial Coast	11,212	French Equatorial Africa	9,705	Burma	4500	Cyprus
13,000	Egypt	11,205	Spain	9,580	Yugoslavia	1995	New Caledonia

Photo courtesy of Arabian American Oil Company

1 To supply its far-flung operations in Saudi Arabia, Arabian American Oil Company maintains a huge warehousing organization at Dhahran which currently stocks 166,000 items. Equipment from many countries shows up in Aramco's inventory. During 1955, Aramco placed orders for almost $63 million worth of equipment, materials, and accompanying freight payments. Much of the material, included heavy fabricated steel structures, foodstuffs, textiles, and other light manufactured goods, as well as drilling, producing, pipe line and refining equipment. Reduction of inventory of obsolete stock always is a problem in any warehousing operation, Aramco's current inventory represents a decrease of 20,000 items from a former peak stock of 186,000 different items. A new $530,000 warehouse will be completed this year at Dhahran to serve as a center for dry foods and to afford better food preservation.

Throughout the World of Oil

Warehouses Are Nerve Centers of Operations

Except for the U. S. and Canada, where supply stores are located at convenient and strategic points, oil producing and drilling companies operating abroad must handle their own individual supplies and equipment needs.

WAREHOUSES ARE nerve centers of oil company operations abroad, just as they are for domestic operations. However, except for Canada, operators abroad face a singular difference: in most operating areas throughout the world, they must care for their own supplies and equipment needs.

In the U. S. and Canada, supply stores are located conveniently throughout the drilling and producing regions and, in most instances, required supplies and equipment will follow a telephoned request in quick order.

But elsewhere, operators must take their entire warehouse stock with them. Since the operating areas likely

A Regent Photo

2 A stores attendant removes a chain tong from the tubular frame rack in the Main Stores building of Trinidad Oil Company, Ltd., at Pointe-a-Pierre, Trinidad. This supply depot area covers 14 acres and includes an administration building, a 40,000-square foot main stores building, and several smaller warehouses. Tubular goods, valves and fittings are stored in the open on racks. To handle the 51,000 coded items in stock, 360 employes are required. Ninety-nine percent are West Indian nationals. Goods arrive at Pointe-a-Pierre by road, rail and by sea via lighters from Port of Spain, 30 miles north, and San Fernando, four miles south. A rail siding in the stores yard allows delivery of 2000 tons of equipment monthly. Two hundred-and-fifty rail cars are used by the company, and a fleet of 15 five-ton trucks is maintained to deliver material to the field. Intra-stores area transportation is afforded by 1 electric crane, 2 mobile cranes, 3 winch trucks, 4 fork-lift trucks, and 2 electric trolleys.

are remote from industrial centers, a variety of items must be stocked and supplies generally must be ordered far in advance.

For operations abroad which are of moderate scope, the stocking of from 35,000 to 40,000 items is required. For a major producing venture, however, the list rises to perhaps more than 100,000.

These company-operated supply stores generally stock the same types of oil field equipment as retail supply outlets in the U. S. and Canada, varying, of course, with local needs. The accompanying photographs of various oil company-operated supply stores and warehouses throughout the world offer a quick evaluation of the tremendous work and planning which are combined to meet the companies' own needs abroad adequately.

Continued on Page 154

A Regent Photo

3 This is an over-all picture of Trinidad Oil Company's Main Stores yard at Pointe-a-Pierre showing tubular goods, rail siding, covered sheds, crane, and part of the Main Stores building in right background.

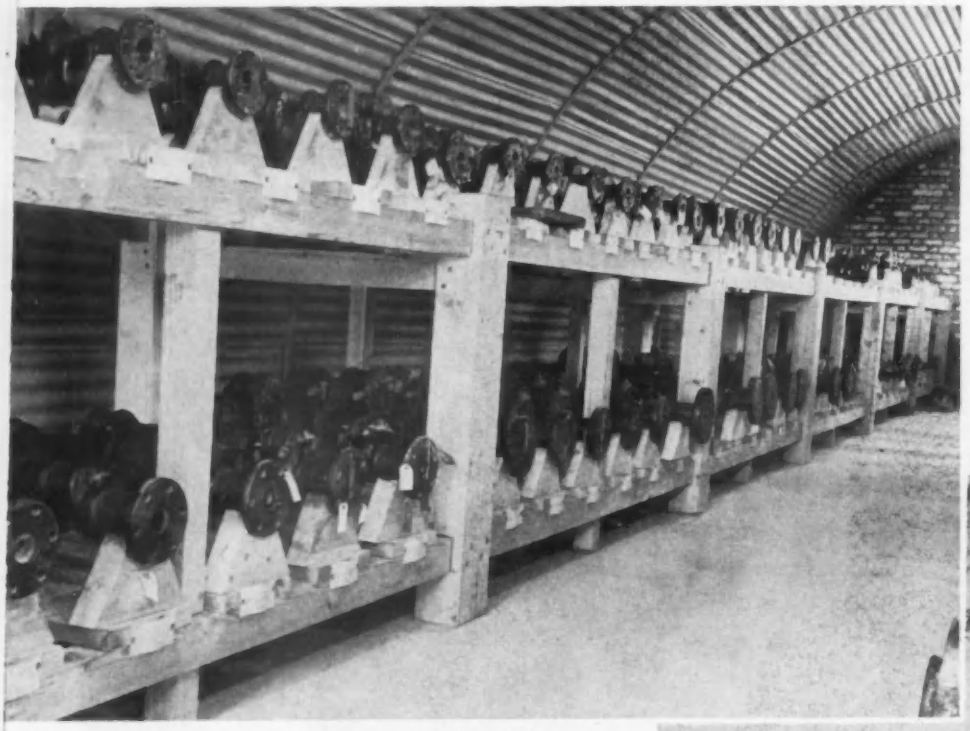


Photo courtesy of Kuwait Oil Company

4 Kuwait Oil Company, Ltd., stocks about 100,000 different items in its Stores Department in the town of Kuwait—from pins to pistons, from cricket balls to crankshafts. Procurement is handled largely by the company's Supplies Division in London. As much as 200 tons of material and equipment, valued at more than $37 million, has been taken into Kuwait in a single year. The staff of the Stores Department includes many nationalities—English, U. S., Irish, East Indian, Pakistani, Syrian, Palestinian, Iraqi, Iranian, in addition to many Kuwaiti nationals.

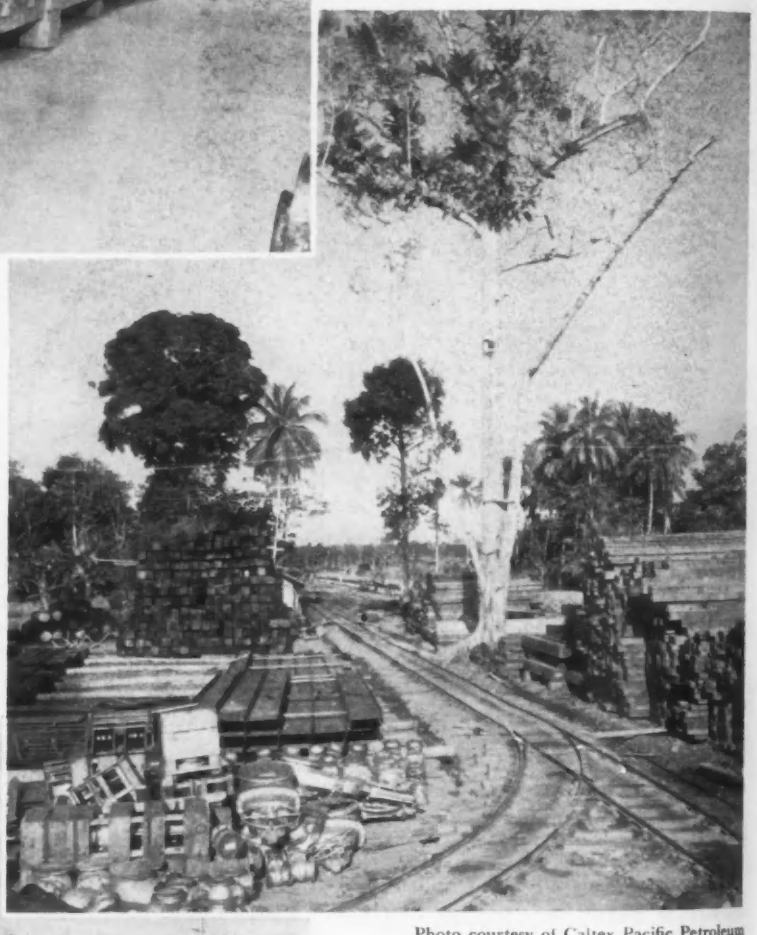


Photo courtesy of Caltex Pacific Petroleum

5 Even warehousing has its temporary, intermediate stages. Prior to completion of its current warehousing facilities, Caltex Pacific Petroleum Mij had an open storeyard at Pakning, in north central Sumatra, that was used during a dry season. The lumber was imported from Oregon since lumber suitable for the company's purpose was not immediately available in Indonesia. Hundreds of piles had to be driven into marshy ground to support the 142,000 barrel crude oil storage tanks that are now used to store crude from Minas field. It was unnecessary to build expenive roads for this storeyard for track for the temporary narrow-gage railway was available locally. Jeeps, with rail wheels, were used to shuttle materials in and out.

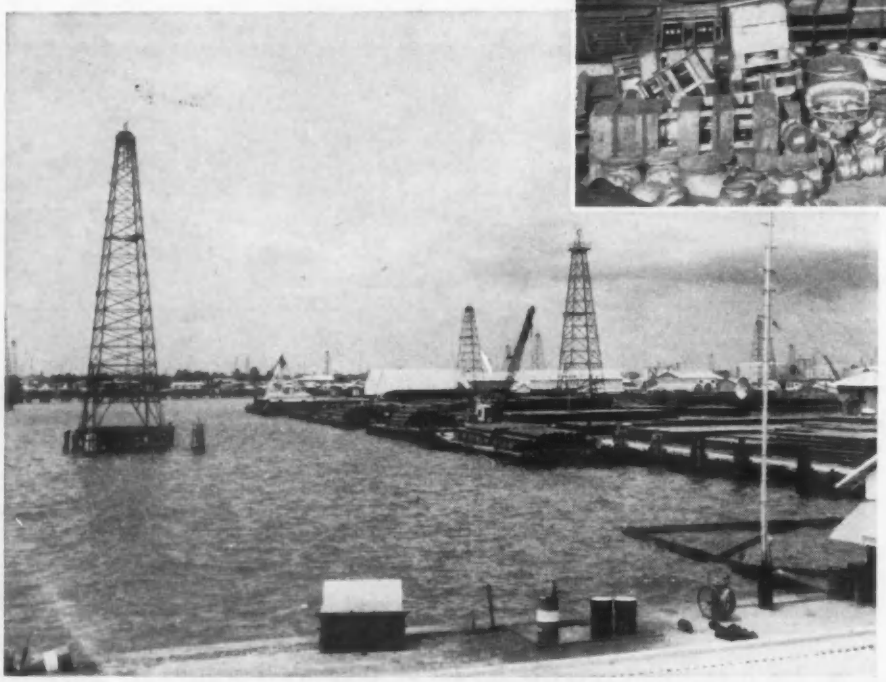


Photo courtesy of Creole Petroleum Corporation

6 Venezuela is an interesting comparison of big company, big concession and big warehousing operations and competitive supply and service company depots. This is a view of Creole's industrial installation at La Salina on Lake Maracaibo in western Venezuela. Derricks of some of the original wells drilled by Creole more than 20 years ago overlook pipe yards, shops, pipe wrapping machine, loading facilities, and a multitude of other installations at La Salina. However, since 14 different companies operate in Venezuela, including some medium-sized and small companies, there is room for competitive supply stores, which are maintained both in eastern and western Venezuela. Within one mile and a half strip on the east side of Lake Maracaibo, eight service and supply companies maintain offices.

—The End

Canada Smashes All Records in '55

- 2766 wells drilled, 127.5 million barrels of crude produced as operators spend $2 million per day.
- Exploratory efforts slack off, but expenditures for finding oil reach new peak.
- Exports a growing problem as producers are hit by the production-market squeeze.

WESTERN CANADA'S rapidly maturing oil and natural gas industry smashed all of its own records in 1955 in every phase of exploration, drilling and production, to round out a year of activity which was the largest, most productive and most expensive in the nine years since the Leduc discovery.

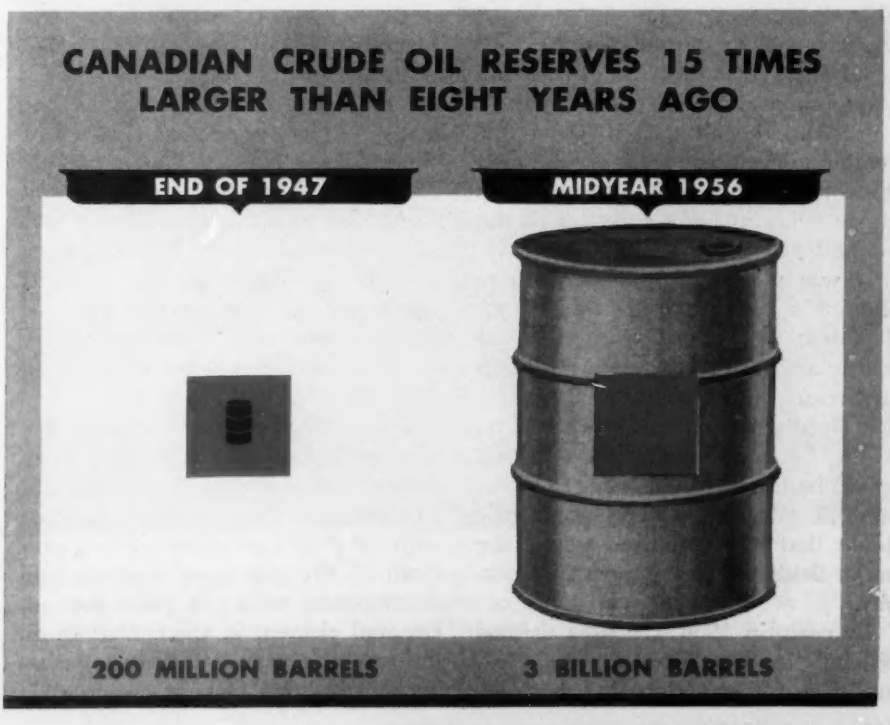
In drilling 2766 wells and producing more than 127½ million barrels of crude oil, operators spent close to $2 million a day and were making a strong bid to go even higher in 1956.

While exploratory effort was less last year, in terms of crew months, than in the 1953-54 peak period, when more territory was available for scrutiny, the amount of money spent reached a new peak in 1955. This was caused by two factors:

- Acceptance of the necessity of dividing exploration regionally according to seasonal facility of working in different areas, forcing operators into the far north in the winter freeze-up period, and bringing them out again at the first sign of spring thaw.
- The much higher cost of exploring in those inaccessible regions where the working day may be only four or five hours long in mid-winter.

The year 1955 brought with it, in sharply recognizable form, the new and growing status of Western Canada as an exporter of crude and natural gas to the U. S. The urgent pressure of an ever-growing producibility of crude, against the limits of a domestic market which is saturated in respect to geographical areas not previously served by domestic oil, brought home to producers in 1955 the reality of the squeeze between production and markets.

The year was outstanding for the penetration of Canadian crude into U. S. market areas where deficiency permitted economic access. For natural gas, the year was only partially successful in the finding of markets. Gas, even more than crude, must seek its major outlets abroad because of the greater contrast between reserves and producibility on the one hand, and the domestic market, highly competitive for other fuels, on the other.


CANADIAN CRUDE OIL RESERVES 15 TIMES LARGER THAN EIGHT YEARS AGO
END OF 1947
MIDYEAR 1956
200 MILLION BARRELS
3 BILLION BARRELS

Saskatchewan Discovery Rate High

In the memory of Saskatchewan operators, 1955 will remain fixed as the year in which the southeastern sector of their province presented them with a remarkable discovery ratio.

In a relatively small block of oil search territory, 100 miles east and west by 40 miles north and south, out of 34 rank wildcats drilled to completion depth, 19 oil discoveries were completed as producing oil wells. At the end of the year, 17 of these discovery wells were still producing, while the other two had been abandoned after producing commercial quantities of oil for several months.

The fields which were discovered had established new recoverable reserves of oil estimated at a minimum of 200 million barrels.

Pembina Highlights Alberta Activity

For Alberta operators, the year was significant as the first major development year for Pembina oil field. Almost totally shut in by sustained wet weather through 1954, Pembina came into its own last year and contributed 672 new oil wells to the finished drilling list of 1165 development oil wells in Alberta. Not a single dry hole was drilled in the whole course of this Pembina program.

The only other field to be developed to any consequential extent in 1955 was the Joffre Viking sand field in the central plains, halfway between Calgary and Edmonton, where 139 wells were drilled as successful oil wells and five dry holes brought the over-all total to 144 completions.

Pembina Activity. Never before has Alberta had such a tremendous concentration of its development drilling in a single field, except during the development of the Redwater field in 1949. And the ultimate scope of this Pembina development far outshadows Redwater along with all the other major fields so far discovered in the foothills province.

It was possible for the first time, after 1955, to get some perspective on Pembina, by comparing operational results with the forecasts of geologists and reservoir engineers before heavy development started. There was no doubt, by year's end, that Pembina would be the largest field ever discovered in Western Canada, and little doubt that it would rank among the major fields of North America eventually.

By early in 1956, the area defined officially by The Petroleum and Natural Gas Conservation Board of Alberta as the Pembina oil field had climbed to approximately 400,000 acres. This area is large enough to support at least 3000 wells for ultimate development. Actually, the ultimate development is calculated quite moderately by the operators at upwards of 5000 wells, which will be spread over a period of several years.

The projected schedule of drilling activity is based on purely practical factors of the ground conditions, availability of drilling rigs, pipe line capacity and growth of over-all markets for Alberta crude.

Crude Outlets a Problem. The market position of Alberta oil was about as tight in 1955 as it has been since 1950. Then the provincial government first adopted compulsory proration at industry's request to equalize the burden of restricted outlets. By the end of 1954, Canadian crude had displaced U. S. crude as the source of supply for British Columbia, the entire prairie region and most of Ontario.

Thus, in 1955, the growth of oil production at a record high rate was due largely to addition of new domestic markets which had been shared previously with imported crude.

The current year's growth of domestic business in western Canada crude oil sales will not be as large as it was in 1955 because this year it will have to depend almost exclusively on normal demand growth for products. The fact that this condition coincides with the largest projected drilling program in the history of Canada's oil development makes it plain that an essential element in the Canadian oil industry this year is the export market for oil.

The prospect opened brilliantly in the first quarter, as exports of crude to the Pacific Northwest states, the northern states and a trickle to Montana refineries boosted the average of exports from 23,070 barrels a day in January, 1955, to the year's average of more than 50,000 barrels daily. The November peak of 79,800 barrels daily was pushed to an average of about 115,000 to 120,000 barrels a day for the first quarter of 1956. These figures are from Alberta and Saskatchewan combined. Total crude oil exports in 1955 reach 17 million barrels as compared with only about 4 million barrels in 1954.

The original projection for 1956 indicated a total export market of almost 43 million barrels, or 2½ times the 1955 market, but the loss of a substantial proportion of the Pacific Northwest outlet during the second quarter strike at the Shell Anacortes refinery probably will lop off about 4 million barrels.

Even so, the 1956 market distribution appears to shape up as 25 percent U. S. and 75 percent domestic, illustrating a practical solution to the need. The total 1956 crude oil production is estimated at about 163 million barrels, an increase of 36½ million barrels over 1955 production of 127½ million barrels. The increase expected is actually divided in the proportions of 63 percent for the U. S. market and 37 percent for domestic markets.

The Canadian crude oil production curve has followed an irregular course over the past few years, leaping upward as new market territories were reached and slumping gradually during periods when new markets had been assimilated and only normal

growth of demand remained to stimulate production.

Supply-Market Gap. The year just past brought into sharper focus than ever before the widening gap between producibility and markets. It was emphasized by the sudden bursting out of development drilling in the Pembina field and by the culmination of a steady trend in both Saskatchewan and Manitoba to a new high level.

By the beginning of 1956 it was estimated that producibility had reached almost 800,000 barrels per day for all Western Canada, against a market of some 450,000 barrels a day, or slightly more than half the capacity. In spite of maximum producing rate adjustments, which have cut the Pembina producibility for individual wells by 25 percent, the extremely high completion rate in the first half of 1956 has more than compensated for this factor.

At the end of 1954 the MPR for Western Canada fields was estimated at 420,000 barrels per day, only comfortably above the market of 330,000 barrels daily. The 1955 year-end found an excess of 95 percent. At the end of 1956, if the trend continued, the MPR producibility of 1 million barrels a day will exceed the market of 460,000 barrels a day by 140 percent.

One of the most informed forecasts of 1955 covered the potential future markets of the next five years. Fred G. Cottle, manager of the Transportation and supply division of Imperial Oil Limited, concluded that the market will grow to a 573,000 barrel-a-day average by 1960. His figures showed a rise in the prairie provinces to 154,000 barrels daily from 123,000 barrels a day, or 25.2 percent; in Ontario to 187,000 barrels a day from 107,000 barrels, or 90 percent; in British Columbia and Pacific Northwest to 173,000 barrels daily from 83,000 barrels, or 108.4 percent; and in the northern states around the Lakehead to 59,000 barrels from 22,000 barrels per day, or 90 percent.

In this forecast, the U. S. market took a prominent place, increasing from 56,000 barrels a day in 1955 to 174,000 barrels by 1960, when it would occupy 30 percent of the total market for Canadian crude.

FIRST SHIPMENT WEST. This is part of the first 46-carload shipment of large diameter pipe from Eastern Canada to the Alberta-Saskatchewan border, starting point of the 2200-mile construction project designed to serve the Ontario natural gas market. A total of 8500 carloads of the pipe will be required. The large diameter pipe, unavailable in Canada, was being imported from three U. S. steel mills.

Imperial Oil Photo

CHRISTMAS TREE IN CHRISTMAS SETTING. Producing well in foreground and two drilling wells in background are symbolic of increased activity in Western Canada. But while production is skyrocketing, marketing is still presenting a problem . . .

Economics Still Stalling Quebec Market Possibility

In the search for crude oil markets, the Quebec area and its approximately 200,000 barrels daily demand, has long been watched. But trying to reach this highly competitive market continues to be uneconomic. Producers are being favored, instead by a shift of emphasis in refining capacity to Ontario and a concurrent extension program which will take the Interprovincial pipe line into Toronto next year.

At the same time, an addition of 40,000 barrels-a-day capacity to the British American refinery in the Toronto area, an expansion of the Canadian Oil refinery at Sarnia to 30,000 barrels daily and an increase to 20,000 barrels a day for the Regent refinery at Toronto will bring Ontario's daily refining capacity up to almost 190,000 by 1958 for companies using Canadian crude. In addition, the Sun Oil refinery at Sarnia, committed to imported crude through inter-company arrangements, has a daily capacity of 15,000 barrels which eventually could be opened to domestic crude.

The increasing emphasis on Ontario, inspired partly by the economics of the pipe line extension and partly by the desire of refiners to decentralize, probably will work to the advantage of western producers by advancing the date for attainment of the 187,000 barrels a day market forecast for 1960. This figure could easily be reached by 1958.

Long Range Outlook. Taking the much longer-range outlook to 1975, the Presentations to the Gordon Royal Commission on Canada's Economic Affairs, early in 1956, marshalled statistics about future production and consumption which predicted a significant rate of growth.

The Shell Oil Company of Canada Limited submission forecast a production climb from an average of 360,000 barrels a day in 1955 to 1,057,000 barrels in 1965, accompanied by a growth in producibility from 560,000 barrels to 1,450,000 barrels daily over the same period, at 7 percent MER.

The Shell submission predicted an improvement in the net import position. While imports of crude were expected to rise from an average of 211,000 barrels a day average in 1955 to 313,000 barrels average in 1965, the increase in exports was expected to raise this factor from 48,000 barrels to 275,000 barrels daily over the same period. This will result in a net decrease from 163,000 barrels to 38,000 barrels a day in excess of imports over exports.

Using slightly different estimated crude production figures for 1955, the Imperial Oil Limited submission predicted an increase from daily production of 352,000 barrels in 1955 to a phenomenal long-range figure of 2 to 3 million barrels a day by 1980. The 25-year calculation was spread to this large extent to allow for the uncertainties of the export market development. According to Imperial calculations, producibility would still be considerably ahead of production in 1980, amounting to between 2.8 and 3.8 million barrels a day.

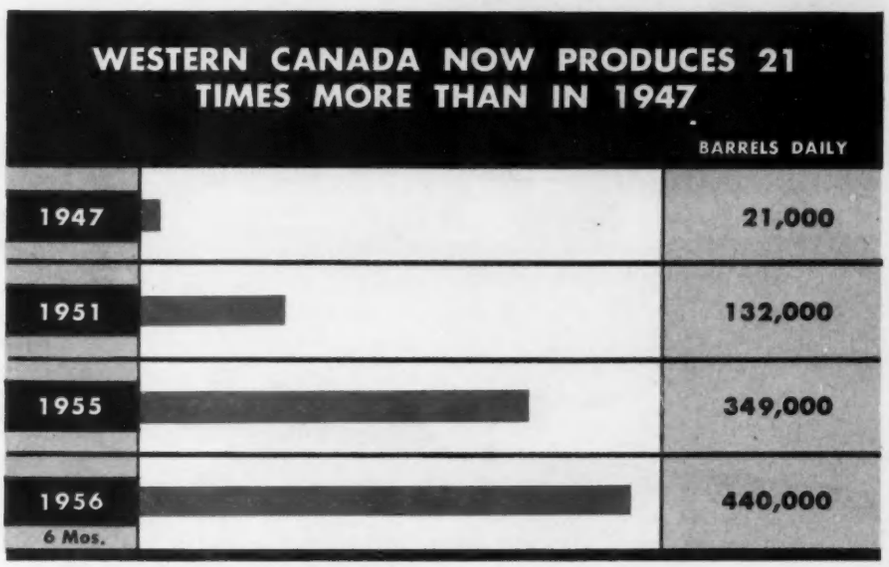
Demand to Triple. A notable feature of Imperial predictions was the estimate that while energy requirements in the next 25 years will double, demand for petroleum will triple, indicating a 50 percent greater increase in petroleum utilization than in the consumption of all other sources of energy.

A glance over the record of the past few years, since the big expansion of crude production following the Leduc discovery, suggests that even this apparently optimistic forecast may be too low.

In 1947 Canadian crude oil production averaged less than 19,000 barrels a day. In 1948 it increased by more than 60 percent to 31,000 barrels daily, in 1949 by 80 percent to 56,000 barrels a day, and in 1950 by 37 percent to 77,000 barrels per day. The next few years recorded a slower rate of growth, with both percentage and total production fluctuating within a narrow range. Increases of 66 percent in 1951 and only 31 percent in 1952 were followed by a modest 32 percent in 1953 and an even smaller 19 percent in 1954. The climb back to 34 percent in 1955 resulted in a record quantity increase of more than 33 million barrels or just about 90,000

barrels a day for an average of 355,000 barrels daily over the year. The 1956 production figure of 163 million barrels would be an average of 446,000 barrels per day, of which something more than 75 percent should be for domestic use.

While unpredictable factors can interfere with any long-term projection, such as the depressing effect of the strike at Shell's Anacortes refinery in the entire second quarter which has cut off of the equivalent of 10,000 barrels per day for the year, it can be seen from these current figures that the 25-year forecast may be conservative. The ten-year forecast, particularly, appears substantially on the cautious side.



Gap Between MER and Markets Widened

In dealing with producibility curves, the effect of the tremendous rate of Pembina field development and the enormous program of drilling out in southeastern Saskatchewan's Mississippian area must be considered as accelerating the spread between the maximum efficient rate of production and markets. The Shell estimate of MER as at the end of 1955 was about 15 percent below actual MPR or maximum permissive rate of production as established by conservation boards in the three prairie provinces.

At the end of 1955 this figure already had reached just a shade under 800,000 barrels a day and it was expected to pass 1 million barrels a day by a wide margin before the end of 1956. By any reasonable extension—and assuming a drill-out of as few as 1000 wells in Pembina and southeastern Saskatchewan combined—in each of the next five years, Western Canada MER should exceed 1.5 million barrels daily as early as 1960.

The Shell submission to the Gordon Commission pointed out that Canadian oil producers are in almost a unique position of geographical disadvantage for markets. Their reserves are a long way—about 2000 miles—from the dense population centers of Eastern Canada which are continuing to lead the growth rate of the entire country, both in population and industry. Ocean-borne petroleum is historically subject to fluctuations in price, due to changing shipping tariffs. Comparing the average terms of low tanker rates with the general cost of laying pipe lines, it is substantially more expensive over the long pull to move a barrel of oil by pipe line than by tanker, Shell concluded.

Western Canadian crude must move by pipe line for long distances before it can reach water transportation: in one direction across the Rocky Mountains and in the other across a large part of the continent. This situation, the submission explained, is basic to the whole pattern of growth for Canadian production. It illustrates how essential it is for the industry to get encouragement for larger markets in Canada to reduce costs and help extend the competitive radius to which Canadian oil can be shipped.

Urgent Problem. It is easier to project problems than to supply solutions, but it is essential that these problems be recognized. An urgent one facing producers in the next five years is this prospective widening of the gap between production and MER. Taking Imperial's estimate of 600,000 barrels a day for 1960 domestic production and allowing an extra 50,000 barrels a day for unforeseen new markets, the spread probably will have increased from about 450,000 barrels daily at the end of 1955 to as much as 900,000 barrels a day in 1960.

At that time excess producibility will be almost 150 percent of current production.

Only one large area of Canada is a potential untapped market for domestic crude: the Montreal refinery market area which was nudging 200,000 barrels a day. Economics of pipe line transportation at present do not give much hope of a successful market invasion from the west. Montreal is served by both water-borne crude from the Middle East and South America and pipe line crude from the U. S. eastern seaboard.

Best Market Areas. The deficiency areas of the Pacific Northwest states and the partially dificient areas of Minnesota, Wisconsin and Michigan, where refineries can use Canadian crude competitively, were shaping up as possible large future export markets. Indications were that they are the safest areas, politically, into which crude can be shipped without antagonizing U. S. producers. This dual factor suggests that their market growth, relatively slow though it may be, offers the best outlet for the bulging producibility in the prairies.

Closely related to production and producibility picture is the course of the discovery rate and the curve of development drilling. Both these factors were favorable in 1955, were continuing on an expanded scale in 1956, and show no sign of slackening.

DISCOVERY TOUCHES OFF BIG LAND PLAY. Union Oil Company of California's Red Earth discovery well tested almost 1000 barrels a day of 38 gravity crude from the Granite Wash in two intervals between 4700 and 4800 feet in February, 1956, resulting in one of Alberta's biggest land plays. About 15 million acres were filed on within 30 days. Currently shut in, as well as drilling operations at two stepout tests, well production and operations were to be resumed as soon as the muskeg freezes to permit travel.

Alberta Paces Completions Gain . . .

Last year marked the first time since 1952 for a general upsurge in well completions. The number of completions in the four western provinces reached 2947, compared with the previous totals of 2262, 2210 and 2156 wells in 1954, 1953 and 1952, respectively.

The increase of more than 30 percent over 1954 was concentrated in Alberta, which had shown a steady decline during the previous two years from its peak in 1952. The 1955 total of 1640 wells barely exceeded 1952's record of 1573 completions. Saskatchewan drilling had an increase of 18 percent, to 911 wells, while Manitoba completions rose 17 percent—to 359 wells. In British Columbia the trend was moderately upward, with an increase of 23 percent to 37 wells.

Wildcatting Declines. The most noticeable feature of 1955 drilling was the decrease in wildcatting accompanied by a higher discovery ratio for oil in all three prairie provinces (British Columbia had no oil discoveries in 1955). Total wildcats numbered only 684 in place of 722 in 1954. Alberta's 303 wildcats yielded 41 oil discoveries, while in the previous year 32 discoveries resulted from 290 exploratory wells. In Saskatchewan 293 wildcats were drilled for 29 oil discoveries, while in 1954 there had been only 19 oil discoveries for 348 wildcats. Manitoba, with 54 wildcat completions, was the scene of 10 oil discoveries, against only 8 discoveries out of 83 wildcats in 1954.

Natural gas discoveries were so prevalent in Alberta that it could almost be said it was a poor wildcat which did not at least show a gas flow some time during the course of drilling, even if it turned out to be a dry hole. There were 52 gas discoveries, in addition to the oil strikes, in Alberta, compared to 46 in 1954. Saskatchewan's gas discovery rate remained constant at eight successful wildcats, the same number as in 1954. In British Columbia the score was 9 gas discoveries out of 34 wildcats drilled.

The lid blew off development drilling in 1955, as Pembina, Joffre and the southeastern Saskatchewan fields racked up a tremendous proportion of the field wells. The total of 2263 development wells was level with the total of all wells in 1954 and almost 50 percent higher than the 1954 total of development drilling. Alberta reported 1337 wells, of which 1170 were oil producers and 70 were gas wells, for an increase of 53 percent. Saskatchewan's total of 618, including 541 oil and 8 gas wells, was up 46 percent. In Manitoba 305 development wells marked an increase of 37 percent with 269 of them being oil wells.

Producing Wells Increase. The addition in a single year of 1980 oil wells to the list of producers in the prairie provinces set an all-time record of almost double the largest previous peak. Pembina alone accounted for 672 new oil wells, while Joffre was the scene of 139 producers. Activity in Saskatchewan was split between the rapidly growing southwestern fields which produce medium gravity crude and the active southeastern sector which contains both medium and light gravity oil.

Pipe Line Spurs Saskatchewan Drilling. The securing of a market for the medium crude through the South Saskatchewan pipe line, completed in the fall of 1954, was the incentive for the drilling of 69 wells in Cantuar, 17 in Success, 15 in Gull Lake, 30 in Battrum, 8 in Bone Creek and 17 in Dollard, as well as scattered wells in minor fields in this area, to make a total of 165 oil wells in the southwest, in addition to 26 dry holes in these fields.

A large-scale, multi-colored, folded map showing the oil and gas fields, pipe lines and refineries in Canada accompanies this issue.

Weather, Terrain Affect Western Canada Drilling

In Saskatchewan, reduction in development wells to 158 in the first five months of 1956 from 214 in the similar period in 1955 marked a transition in concentration of activity to the southeastern sector. Significance of the major increase in drilling in this difficult area of few roads and many swamps and creeks stands out in comparative figures. This year, 122 field wells have been drilled in the nine principal fields, while last year the count for the first five months was only 43. At the present time, there are more than 60 drilling rigs in the region, with 25 operating in the Steelman field where wells were being completed at the rate of almost one a day.

The reverse has occurred in the other two major development areas. In the Coleville-Smiley-Eureka fields, the 17 completions in the first five months of 1956 was in sharp contrast to the 95 last year, owing to the fair degree of market saturation. The southwestern fields, also leveling off from the rapid drilling out of the 1955 market preparation program, were responsible for only 13 development wells drilled this year as compared to 57 last year.

Manitoba development drilling also was handicapped by the severe winter which cut off almost all side roads until May, when the road bans went on, and made it virtually impossible to move drilling rigs to any locations not on main highways. Out of the 60 development wells drilled in the first five months of 1956, 46 were in the three principal fields: Daly, North Virden and Virden-Roselea. Last year's total for these fields in the same period was 75 wells out of a provincial total of 98.

Altogether, across Western Canada, the total of 995 wells drilled in the first five months of 1956 compared favorably with the 920 completed last year. If the seasonal bulge of summertime drilling continues at the June pace, 1956 well completions should exceed 3300 wells—another record.

1956 Drilling Highlights. The phenomenal drilling rate in southeastern Saskatchewan will be the highlight of 1956 operations, overshadowing Pembina because of the large number of individual fields involved in this 4000-square-mile region. It is estimated that in Steelman field 400 to 500 locations remain to be drilled for full development. Midale field is calculated to contain fully as many. There are vast stretches between fields which are being filled in without drilling any dry holes, and the composite area occupied by Frobisher, Steelman, Lampman and Kingsford fields was showing symptoms of being one large reservoir

. . . Spurt in the Southeast

In the southeast, although the great wave of discoveries was only sweeping in at the beginning of 1955, operators drilled 22 oil wells in Alida, 14 in Frobisher, 10 in Hastings, 7 in Kingsford, 6 in Lampman, 51 in Midale, 46 in Nottingham, and 34 in Steelman for a total of 190 wells completed as producers. In addition there were 7 dry holes completed in this region of exceptionally successful development drilling.

Saskatchewan. In northwestern Saskatchewan the Coleville and Smiley fields continued active, with 22 completions in the Smiley light gravity field, including 19 oil wells, and 37 in the Eureka light oil field, where 35 wells were successful. In the heavy gravity Coleville field, 79 wells were drilled and 78 were completed as oil wells. This region is the main source of supply for the two refineries in the same area, one of which handles light gravity crude and the other heavy gravity.

Manitoba. Manitoba operations were concentrated in the Virden area fields, where 48 wells were completed in the Daly field, including 39 oil wells; 98 in the North Virden field, of which 96 were oil wells; and 95 in the Virden-Roselea field, including 88 oil wells.

Alberta. Going into 1956, the pace of development drilling increased in Alberta but slackened substantially in Saskatchewan and Manitoba, as well as in British Columbia, where large natural gas development drilling program did not get under way until well into June. The first five months' cumulative figures for 1956 show that 995 wells finished drilling, while last year the count for this period was 920.

Alberta was ahead by 35 percent, with 678 wells drilled as contrasted with 492 in the first five months of 1955. Saskatchewan had 227 completions, down 30 percent from the 295 wells drilled in 1955. Manitoba drilling declined 34 percent from 111 last year to 76 completions this year. British Columbia, with 14 completions, was off a third from the 22 wells drilled last year.

1956 Exploration. Wildcat drilling has held its pace on the prairies, with small increases in Alberta and Manitoba offsetting a moderate decline in Saskatchewan. But British Columbia's wildcatting pace this year is only a small fraction of last year's. The total number of wildcats in the first five months of 1956 was 214, down from 229 last year. More than half the prairie wildcat program was carried out in Alberta, where 123 wildcats were drilled. Saskatchewan accounted for 69 exploratory ventures, against 81 last year, and Manitoba for 16 in 1956 as compared with 13 in 1955. Wildcats numbered only 6 in British Columbia in contrast to 20 in 1955.

Canadian Drilling Shoves Natural Gas Reserves to 19 Trillion Cubic Feet . . .

	Alberta	Saskatchewan	Manitoba	British Columbia	North West Territories	Ontario	Quebec	New Brunswick	Total
Gas Reserves Cu.Ft.	15,572,500,000,000	425,175,000,000	0	3 Trill. approx.	0	161,058,484,000	0	0	19.1 Trillion
Producing Oil Wells at end of 1955....	5,511—Actual 6,138—Capable	1,655—Capable	486—Actual 554—Capable	None—Actual 1—Capable	26	1,433		55	
Number of wells completed during 1955:									
Oil.....	1,145	564	273	1	0	48	0	3	2,034
Gas.....	138	12	0	12	1	143	1	0	307
Dry.....	331	333	69	23	29	188	8	5	986
Total.....	1,614	909	342	36	30	379	9	8	3,327
Footage drilled during 1955.....	8,444,578	3,245,666	841,580	231,768	30,260	475,973	10,226	17,196	13,297,247
Number of refineries	10	9	4	5	1	6	5	1	41
Total daily crude charging capacity:	78,500	67,800	29,800	66,500	1,500	148,800	210,000	300	603,200
1955 daily average crude runs to stills	62,090	46,718	N. A.	N. A.	(Near Capacity)	134,000	195,000	N. A.	437,808

of light crude with possibly 2000 ultimate well sites.

For Saskatchewan, the completion of 800 development wells in 1956 will not be a difficult mark. And even that figure could be exceeded if the continuation of the high discovery ratio results in several more discoveries of pools in new parts of the region. Manitoba development drilling is not likely to fall below 200 completions this year.

The outstanding feature in wildcatting was the persistency of discoveries in the southeastern Saskatchewan sector. In the first five months of 1956 there was the phenomenal discovery ratio of only a little less than one in two, as six oil discoveries were made in the course of drilling 14 wildcats.

The 1956 wildcat program was expected to carry on at about the same rate as last year, with a minimum of 650 to 700 wells in Western Canada, and an early onset of winter would actually stimulate wildcatting by permitting early access to the northern muskeg region.

The discovery ratio in the first five months of 1956 set a strong pace in all provinces except Manitoba, with the other provinces showing improvement over entire 1955. Alberta yielded 21 oil and 17 gas discoveries to 85 dry holes. Saskatchewan drilling resulted in 10 oil discoveries for 59 dry holes. Manitoba operators scored only two discoveries for 14 dry holes. In British Columbia the three gas discoveries to three dry holes set an extremely high ratio.

Added to the 1955 success ratio, this record over a period of 17 months probably has never been exceeded anywhere in an area of similar size for such a prolonged period. It is only to be expected that a rush of drilling activity such as has seldom been seen in any area of Western Canada should have flooded the whole southeastern corner of Saskatchewan with rigs, service crews, supply houses, and pipe hauling trucks. This sudden expansion has been largely responsible for raising the number of active drilling rigs in Western Canada to 248 at the middle of June. This number has not been exceeded for any sustained period of time in the past and represents effective utilization of all the rigs available. For the first time in several years, there is an actual shortage of rigs. Footage rates in Saskatchewan are understood to have firmed up considerably above the going price in any other part of the prairies.

This remarkably sustained completion rate has pushed the number of producing oil wells in Western Canada up to 8300 at the end of 1955 and to more than 9000 at the end of May, 1956, with 700 new producers being added to the list in the first five months of this year. Of the current total, 1100 are in the Pembina field, 1300 in the aging Leduc-Woodbend field and 905 in Redwater, which is now past its peak after nearly eight years.

If the trend of the first five months is sustained and if Pembina and southeastern Saskatchewan continue their rapid development, the number of producing wells by the end of the year should be close to 11,000.

Preferred Market Prospects. Signs are prominent that the tremendous rate of growth in southeastern Saskatchewan, aided by the completion of the first major crude oil pipe line out of the region by Westspur Pipeline Company, a subsidiary of Imperial Oil Limited, will put this group of fields in a preferred position for crude markets at the expense of a slow-down in outlets for Alberta crude.

Exploration Fails to Keep Pace With Drilling Rate

Exploration activity has not increased comparably with the drilling rate. In 1955, the first year since 1952 to show any increase, 1598 crew months were worked, as compared to 1590 in 1954. The peak was established in 1952, when 2042 crew months were recorded.

Seismograph operations accounted for all but a very small proportion of the total. The only province to show an increase was British Columbia. There, the effect of several big farmout programs, mostly in search of natural gas, was apparent in the initial stages when exploratory operations were required to locate prospective sites for drilling.

So much exploration was done over a large area of Western Canada in the early period following the Leduc and Redwater oil discoveries that the ground work was established for a considerable increase in the drilling rate without a corresponding rise in geophysical activity. This trend appears likely to continue. Exploration crew months cannot be expected to increase materially although the locations of greatest intensity will shift with successive discoveries.

Winter Helps. A pattern of seasonal operations has been pretty well established, and geophysical operators have given up any serious hope of conquering the northern muskeg for summer work. An intensive period of work usually is called between December and April, when the average number of crews at work in Western Canada can be expected to reach as high as 175. In the summer, when work is available only on the plains, the number of crews was expected to remain at around 100 to 120.

The seasonal cycle has been developed out of the experience of several years' work in the far north which has convinced operators that below-zero weather is preferred over any summer attempt to navigate in muskeg country. Open water and soft ground of summer muskeg form an almost impassible barrier to movement by any means except helicopters.

Granite Wash. The past winter indicated a rising interest in the far north, inspired by the Granite Wash discovery. But the rush of exploration activity which resulted in some 20 million acres of rights being taken out by a large number of major companies has proved to be a little overoptimistic. There have been cancellations in recent weeks running to at least one-quarter to one-third of the original permit areas.

There is a general tendency for operators to look to the vast reaches of the north country for large-scale exploration territory. It is a region which only a major company can handle. It must be considered as a long-range operation with careful planning of all phases and the expenditure of several million dollars as a minimum outlay. These features are exemplified by the fact that exploration permits are still available on an application basis without payment of a cash bonus. There is little doubt that more exploration and drilling crews will move north next winter. Meanwhile, there is little doubt, either, that the Granite Wash flurry has subsided and operations will be on a very realistic basis of weighing capital expenditure against long-term probabilities of success.

Export Possibilities Cheer Natural Gas Producers

This is the attitude which potential producers of natural gas have had to take for a long time, and it still characterizes the thinking of most oil men in Western Canada about the production of gas for pipe line demand. The year just past was by far the best in the history of natural gas operations because it brought to reality the first prospective export of some of the tremendous surplus reserves which have been shut in for upwards of four years for lack of market.

This opening of the door for gas was achieved by the efforts of Westcoast Transmission Company Limited in securing a permit from the Federal Power Commission to export a substantial quantity of gas to the Pacific Northwest states. Granting of the permit early in November, 1955, made it possible for Westcoast to proceed immediately with a seven-year-old plan for a 30-inch natural gas pipe line running 650 miles from the enormous Fort St. John field in northeastern British Columbia to the international border south of Vancouver. There, the export gas will enter Washington.

The Westcoast project will provide a firm market for a minimum quantity of 300 MMcf per day under a 21-year contract with Pacific Northwest Pipeline Corporation. The entire potential market in the interior of British Columbia and in the city of Vancouver is also tributary to this major pipe line, and estimated throughput by the fifth year of operation is at least 400 MMcf per day.

Largest Gas Field. Completion of the Westcoast line is scheduled for the fall of 1957, and, in anticipation of requirements for the high load which will be required immediately on the start of deliveries, approximately 70 wells will be drilled in the Fort St. John field.

The potential of Fort St. John alone probably is enough to support the pipe line, but gas also will be drawn on a limited scale from the Alberta fields of the Peace River region, across the provincial boundary from Fort St. John.

Wellhead Gas Price. From the Alberta side, gas will be drawn initially from a concentrated group of fields which will be tied in to the main pipe line through 224 miles of gathering lines. These fields are Belloy, Braeburn, Dunvegan, Gordondale, Pouce Coupe, Pouce Coupe South, and Tangent.

Purchase contracts between Westcoast and the five principal producing companies on the Alberta side provide for a maximum of slightly over 100 MMcf per day, which is close to the limit allocated in the Alberta Conservation Board permit. Since half this amount is contracted for with the Pacific group itself and since the well head price will start

at approximately 6 cents per MMcf, with escalation to 10 cents only in five years from the start of deliveries, it can readily be seen that the Westcoast line will not provide any substantial incentive to explore for further gas reserves on the Alberta side.

Proration Situation Favors B. C. Drilling Over Alberta

On the British Columbia side of the border, however, no proration or allocation of reserves is in effect, and this situation has stimulated gas wildcatting, with the favorable results of three new indicated fields or pools in six wildcat completions.

In the other direction, southern Alberta gas is committed to export by way of the 34-inch pipe line being laid by Trans-Canada Pipe Lines Limited. This project, handicapped by government's insistence that it must follow an exclusively Canadian route, still is seeking permission to reach northern U. S. markets.

Construction of the 575-mile line from the Alberta field gate to Winnipeg, likely to be completed this year, will not provide enough volume initially to pay the interest on the capital investment. And it is likely to remain in deficit position for at least the first two years.

Gas Supply Assured. Trans-Canada's supply of gas is assured by the commitment of reserves in Alberta amounting to at least 4350 billion cubic feet. But its sales contract position is extremely marginal, with a visable load of some 25 MMcf per day in the Toronto area, once its line reaches this ultimate destination, and a maximum of about 30 MMcf per day in Western Canada after the first five years' build-up.

As in the case of Westcoast, the Trans-Canada market must be found in the U. S. in order to establish an intermediate delivery of large size which will support the long distance of some 2200 miles between the Alberta fields and the southern Ontario consumption area. A contract exists between Trans-Canada and Tennessee Gas Transmission Company, one of its principal owners, for the export of at least 200 MMcf and up to 400 MMcf per day at the Manitoba-Minnesota border. This contract is the subject of a pending case before the Federal Power Commission, and is being contested by a large number of other gas pipe line companies, by coal and oil interests, and local utility companies.

The Alberta fields which have been committed to Trans-Canada's pipe line are not subject to allocation of specific quantities. The limitation which was introduced into the original export permit of May 15, 1954, was removed by amendment of the Conservation Board last February as unrealistic in view of the limited near-term market for gas through the Trans-Canada line.

Export Area Field. Among the fields in the export permit area, the principle ones are Pincher Creek, Cessford, Provost, Nevis, and Homeglen-Rimbey, which account for 75 percent of the reserves in the southern Alberta region. None of these fields, however, can be opened up economically for a partial load factor. Their prospective utilization will have to wait establishment of much larger markets than can be foreseen within the next two years.

Ontario Activity Increased. Activity in Ontario during 1955 increased in all categories. Exploratory drilling was up 7 percent; development drilling was up 3 percent; oil production was up 26 percent; and gas production was up 4 percent over the previous year. Among the results of the increased exploratory drilling was the establishment of new Guelph reefs in Huron County. In addition, a Guelph gas discovery was made in Lake St. Clair, and an extension was made of the Guelph gas pool in Lake Erie.

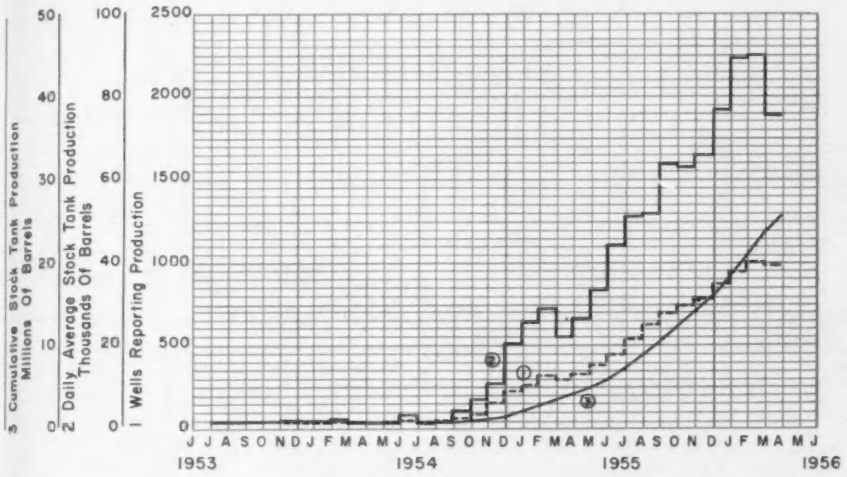
Quebec Exploration Continues. During 1955 drilling was carried on in nine significant test wells in the St. Lawrence Lowlands, one of the wells producing gas of unannounced volume.

New Brunswick Gains. Operating under a special lease agreement with New Brunswick Oilfields, Ltd., the Oklahoma operator, O. H. Parker, completed five wells in Stony Creek field. Three of them were oil producers; one dry hole; and in a previously abandoned 3400-foot wildcat four miles east of the field, some oil was obtained following reconditioning work and a fracturing job. Production in the latter well was non-commercial, however, and the well was re-abandoned. At year-end, the operator was drilling another development well. Total footage drilled in the field during the year amounted to 15,977 feet.

Estimated Proved Reserves of Liquid Hydrocarbons in Canada‡
(All Figures in Barrels)

	Proved Reserves End of 1954	Changes in Proved Reserves Due to Extensions (New Oil) and Revisions During 1955	Proved Reserves Discovered in New Fields and in New Pools in Old Fields in 1955*	Production During 1955	Proved Reserves End of 1955 (Columns 1, 2, & 3 Less Column 4)	Increases in Reserves During 1955 (Column 5 Less Column 1)
CRUDE OIL	(1)	(2)	(3)	(4)	(5)	(6)
Northwest Territories	26,172,000	27,939,000	.....	404,000	53,707,000	27,535,000
Alberta & British Columbia	1,928,479,000	310,978,000	41,862,000	111,334,000	2,169,985,000	241,506,000
Saskatchewan	222,365,000	7,418,000	18,125,000	11,036,000	236,872,000	14,507,000
Manitoba	29,127,000	16,743,000	3,539,000	4,198,000	45,211,000	16,084,000
Ontario & New Brunswick	1,471,000	2,783,000	40,000	535,000	3,759,000	2,288,000
Total Crude Oil	2,207,614,000	365,861,000	63,566,000	127,507,000	2,509,534,000	301,920,000
† NATURAL GAS LIQUIDS	208,331,000	40,404,000	750,000	2,400,000	247,085,000	38,754,000
TOTAL LIQUID HYDROCARBONS IN CANADA	2,415,945,000	406,265,000	64,316,000	129,907,000	2,756,619,000	340,674,000

* Only a limited area is assigned to each new discovery even though the committee may believe that eventually a much larger area will produce, because in this report the committee is concerned only with actually proved reserves. Hence, figures in this column may be considered minimum figures.
† All natural gas liquids located in Alberta and British Columbia.
‡ Source: Canadian Petroleum Association.



These curves, compiled by the Alberta Petroleum and Natural Gas Conservation Board, afford a quick picture of the Pembina field's Cardium sand history from initial discovery in mid-1953 down to April, 1956. Note high rate of completions and mounting daily production.

Pembina Paradox

It's Canada's No. 1 producing area, but some wells unable to meet allowable.

THE IMPORTANCE of Canada's Pembina oil field, discovered three years ago, is unquestioned. It is Canada's No. 1 oil producing area.

But even with its record production, Pembina is a paradox. Estimates of ultimate recoverable crude reserves vary within a range of hundreds of thousand of barrels; yet, operators have found a certain percentage of wells unable to produce anywhere near market allowable.

Young though the field is, secondary recovery methods on a vast scale were urgently recommended to assure that sections of the field will produce a reasonable percentage of the ultimate potential. The result is a proposed hot water injection program authorized recently by the Alberta Petroleum and Natural Gas Conservation Board.

Reserves. Operating conditions vary widely at Pembina and no common denominator can describe performance. Many wells have produced steadily and without interruption since their completion. Others fell off rapidly and pumps had to be installed in increasing numbers.

Permeability, or the lack of it, recently came up for considerable attention among operators. Performance of the field's Cardium reservoir was such that engineers took second looks at some of the optimistic forecasts made in 1953 and 1954. One view has it that the reservoir is blocked off in a honeycomb of individual pools.

Pembina probably extends over an area of some 200,000 acres, although it remains to be seen whether all of this area will be developed economically. Assuming 80-acre spacing over most of the area, it has been estimated that about 4000 wells will have to be drilled before the field is completely drilled out. More than 1000 have been completed.

One estimate places reserves at around 3000 barrels per acre in the proven economic area of the field, although this is another figure that varies widely. Recoverable reserves are considerably depleted on the flanks of the producing area where the Cardium sand is thinly developed.

Taken as an average for the area as a whole, the 3000-barrel figure would put reserves at around 600 million barrels. Much more optimistic estimates were made in Pembina's earlier stages. Now, much will depend on fluid injection and other conservation measures, it appears. Proper pressure maintenance, one authority said recently, could increase recovery as high as approximately 9000 barrels per acre. On that basis, recoverable reserves might be in the order of 1.8 billion barrels.

Pressure Decline. Focal point of Pembina's problems, the Alberta conservation board was told, is the rapid initial decline in pressures which has developed over a big area due to the oil being under-saturated. It appeared that in some parts of the field formation pressure was below the bubble point of the oil.

With the not-uncommon rapid drop in pressures, wells have needed artificial lift facilities—a situation which became apparent during the winter of 1955-56. Installation of pumping units at that time was extremely difficult. Operators were attempting to install foundations in ground that was frozen solid.

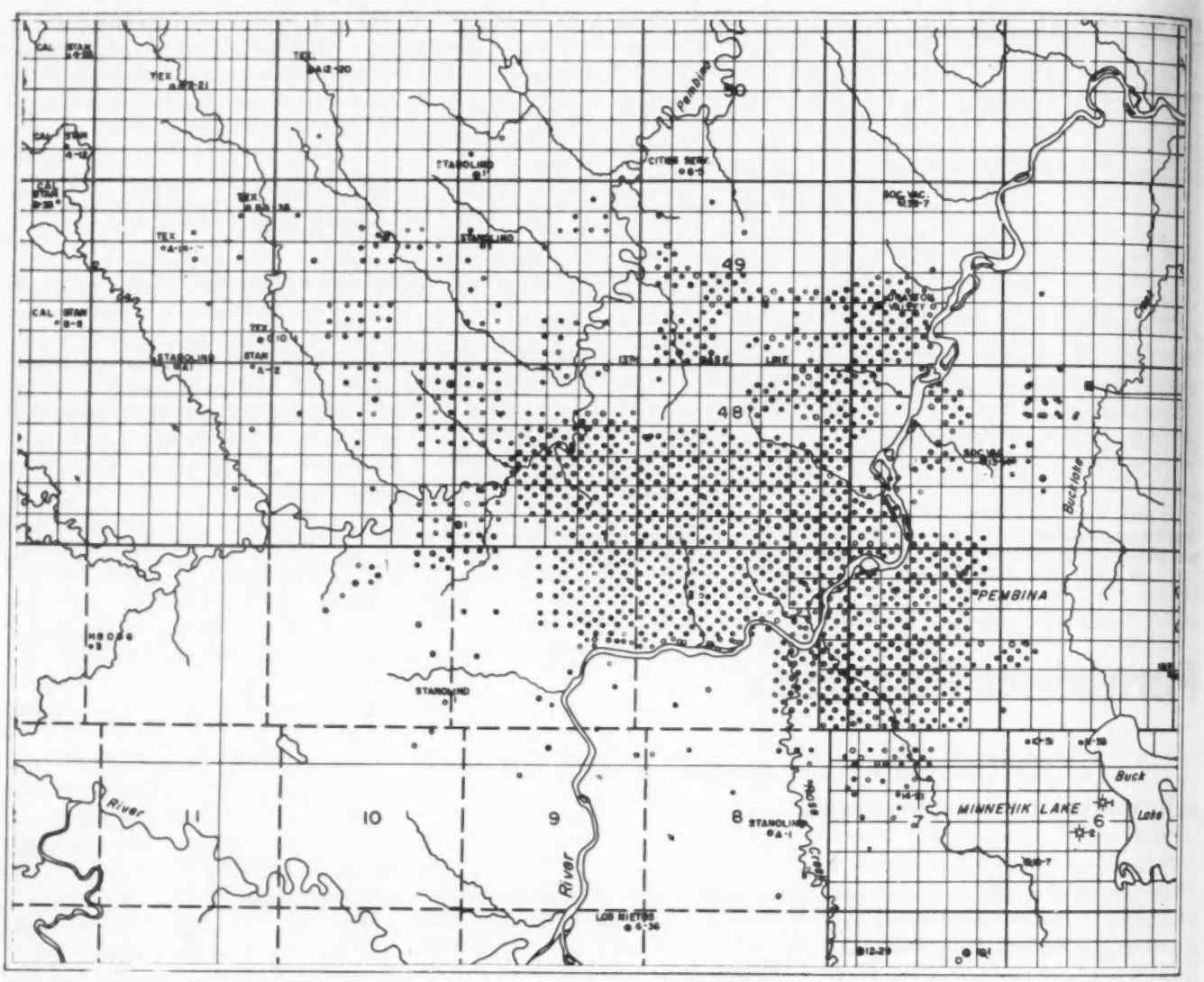
The need for electric power was obvious fairly early in the field's development. Because of the vast extent of the producing area, there were long delays in getting electricity in to scattered wells.

Pembina, like every other oil and gas area in Western Canada, is affected by road bans during the spring thaw. The bans came early and lasted a long time this year, halting the movement of drilling rigs for about six weeks.

Housing facilities at Pembina are slowly catching up with the demand. Workers in the field carried on under extremely uncomfortable conditions through two winters of intensive operations.

One oil man said that Pembina lacks housing, schools, doctors and "anything else you would care to mention." He conceded, however, that the situation is improving. The community of Drayton Valley has grown in population from 50 to 2500 persons to become the center of Pembina activity. Recently incorporated as a town, Drayton Valley has scheduled an extensive and complete public works program.

Despite the growth of this new oil town, Drayton Valley can serve only a limited part of the field. The main section of the Pembina field extends roughly 18 miles to the north and



This map of the Pembina field illustrates the fringe development and step-out wells of this Cardium sand field. Map was prepared by Nickle Map Service, Ltd., Calgary.

south, and 26 miles east and west, with additional scattered production outside that district.

Northwest Limit. The northwestern limits appear to end at about the northern extremity of Township 50 (west of the 5th meridian). The California Standard Company has completed four successful Cardium wells on the west flank of the field, and Texaco Exploration is developing a 92,000-acre reservation between Cal-Standard holdings and the main producing area. To the southeast is the Buck Lake area, where Canadian Seaboard Oil Company and associates have pushed production to Section 26-45-7 (west of the 5th meridian).

From the northwest to the southeast extremities, Cardium production extends about 35 miles. While Pembina grows, some Cardium encouragement has been received in other sectors of west-central Alberta.

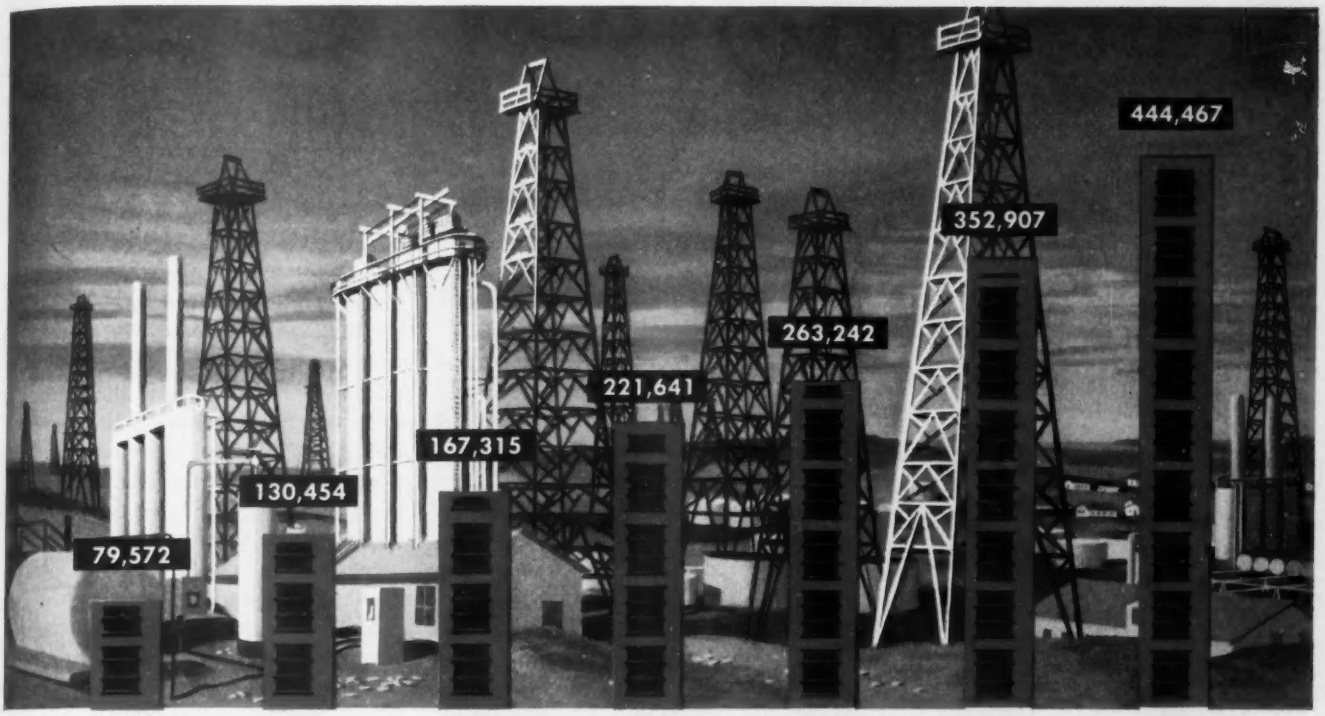
Production methods at Pembina are geared to the nature of the productive sandstone, which dictates that the majority of wells must be fractured to become satisfactory producers. The oil is generally high in paraffin content so that wax deposition in both tubing and flow lines has to be removed periodically. Waxing problems, in many cases, have necessitated heating crude for shipment so that pipe line pumps can handle it during the winter months.

Crude in quantities up to 100,000 barrels daily is shipped by Pembina Pipe Lines Ltd., to Edmonton, where it enters the Interprovincial pipe line system to the east, and the Trans Mountain pipe line system to the West Coast. Pembina currently is producing a good deal of surplus gas which, it is expected, soon will be marketed or utilized for secondary recovery.

Careful Engineering. A Pembina operator pointed out recently that the field can be considered one of the few very large oil areas which has been very carefully engineered during its development, with extensive coring, sampling and analysis of reservoir fluids and studies of reservoir pressures. The field had been "very carefully guided" due to its large area and the great interest shown in it. There is not always full agreement, however, on how it should be handled for maximum future benefits.

The continued study of the Pembina reservoir, which, with its many uncertainties, was once described as posing the biggest problem facing the oil industry in Canada, resulted this year in what has become widely known as the "Lewis Report."

Warm Water Injection. The report was prepared by James A. Lewis En-



(Approximate production figures in barrels per day)

Canadian Oil Barrels Ahead!

Canada's 1955 oil production was up a remarkable 34% over 1954, and for the first month of 1956 production was running 26% over the average figure for 1955. A big oil find has recently been reported north of the famous Peace River district and it has precipitated the "biggest oil rush" in the history of Northern Alberta.

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gineering, Inc., petroleum reservoir analysts of Dallas, for Canadian Seaboard Oil Company. It dealt with extensive Seaboard holdings in what are designated as the Buck Creek, Wolf Creek and Buck Lake areas of the Pembina field. It recommended the injection of hot water as the best way to increase Pembina's productive capacity.

Proposed in the Lewis report was a program of pressure maintenance which, The Texas Company believed, would more than triple ultimate recovery from the Buck Creek and Wolf Creek sectors. Presented at a recent hearing of the Alberta Conservation Board, the plan won the Board's approval and work on its recommendations is going ahead.

The report proposed that every other well in the affected area become a water injection well. Allowable production rates for the remaining wells would be doubled. As each barrel of oil is removed from the field, a barrel of water replaces it.

Warm water injection is proposed to be carried out on a 160-acre enclosed five-spot pattern. Because heating the water is necessary and with a possibility that gas, propane or carbon dioxide injection may become practical, long-range commitment of the area's gas reserves was not recommended. Five water injection plants are to be built.

Work on the initial water injection program, started in May, was slated for completion this year. Meanwhile, other operators, including Mobil Oil of Canada Ltd., which discovered the field in 1953, and Stanolind Oil and Gas Company, are looking into other proposals for gaining increased production.

Because of the field's size and importance, Pembina's problems are the subject of lively discussion and debate among petroleum engineers throughout Canada.

Productive limits of Leduc, where the modern Canadian oil boom began in 1947, and Redwater, are well defined. Its problems notwithstanding, Pembina today has by far the greatest potential of any oil field in Canada. Faith in the future was amply demonstrated last May 24 when more than $18 million was paid at an Alberta government sale of oil and gas rights in the Pembina area.

Here's a Breakdown of '55 Western Canada Discoveries

CARDIUM AND VIKING sand oil discoveries overshadowed Devonian reefs in Alberta throughout 1955 and the first half of 1956. The trend along the east slope of the Rocky Mountain foothills, sparked by the sensational discovery of Cardium sand oil at Pembina in 1953, has paid off during the past 18 months with a series of significant strikes, some of which show all the symptoms of developing into major fields.

Pembina field itself, which did not get into full-scale development until the 1955 drilling season, has been extended by many important step-out and wildcat wells which have delimited a total productive area of at least 480,000 acres with continuous oil saturation.

The trend of Cardium sand accumulations extending south of Pembina has proved a prolific source of discoveries over a distance of more than 100 miles. So many blank spaces remain to be filled in by further wildcatting that the entire foothills region between Edmonton and Calgary presents a challenge to exploratory drilling with good prospects.

Joffre Viking Trend. Cutting diagonally across the Cardium trend, from southeast to northwest, is the new Viking sand trend at the central plains, which starts at Joffre, 100 miles south of Edmonton, and runs in an apparently continuous structure for about 60 miles west by north to Gilby West, by way of Joffre West (now incorporated by definition in Joffre), Bentley, and Gilby. In the short space of two and one-half years, this trend has become the most significant Viking sand accumulation in Alberta. The Joffre field itself is approaching 10,000 barrels a day in current production to rank among the top ten fields in the province.

Granite Wash. Discovery of oil in a new formation in Alberta, the Granite Wash, which directly overlies the Pre-Cambrian basement, created a sensational rush of major companies early this spring into the far northern areas to stake large exploration permit reservations. Disappointment over extension drilling, however, coupled with the high cost of exploration work and wildcat drilling in these muskeg regions, erased some of the glow off the first flush of excitement. The northern areas are no place for small companies, even in groups, and the remote geographical location has caused even major companies to proceed cautiously in setting up programs. They consider their reservations as a hedge against future possibilities rather than an investment for immediate development.

Despite disappointing development of natural gas export plans, Alberta gas discoveries have been reported with phenomenal regularity.

Gas Activity Spurred. Anticipated completion of Westcoast Transmission Company's gas transmission line to the Pacific Northwest area late in 1957 has spurred a major gas search program in the Peace River area of northwestern Alberta and northeastern British Columbia.

Fields which were first discovered in this Peace River area in 1951 and subsequent years have been lying undeveloped, except for broad delimitation by long stepout wells. But the last six months have witnessed a revival of activity which has resulted in several major extensions and several new field discoveries.

This area and the contiguous region of northeastern British Columbia, which provide the bulk of the reserves for Westcoast Transmission Company pipe line now under construction, must be considered as a unit in terms of exploration and wildcatting. Incentive, however, is considerably greater on the British Columbia side because there is no proration of potential gas production in that province. Alberta has established a schedule of deliverabilities for the individual fields in the export permit area, with a maximum overall volume of gas for delivery to the pipe line.

Prospects in this extremely large Peace River region are almost un-

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limited, as experience of wildcatting over the past several years has shown a remarkably good discovery ratio. There are almost a dozen producing horizons in the various parts of the region. The principal field, Fort St. John on the B. C. side, alone, has six zones which are capable of producing in volume ranging from marginal to extremely high commercial rates.

Following, grouped by provinces, are principal recent discoveries and extensions, together with significant facts relating to each:

ALBERTA:

• Pembina, 75 miles southwest of Edmonton, was discovered June 20, 1953.

• Cynthia reserve, 10 to 20 miles west and northwest of Pembina field limits as of January, 1955, now is included in field by definition. Operators: Texaco Exploration Company and McColl-Frontenac Oil Company Limited.

• West Cynthia Reserve—adjacent to and west of Cynthia Reserve. Operator: The California Standard Company.

Development to Continue. The principal producing formation in the Pembina area is the Cardium sand, although some small accumulation is found in the Belly River sand on the east flank of the field. Depth ranges from around 4600 feet to 7000 feet across the regional dip. Crude is of 37 gravity; average net pay zone thickness is 21.65 feet; porosity is 14.52 percent; calculated MPR is 154 barrels per day, average; and individual initial production maximum is about 500 barrels per day.

By the end of May, 1956, almost 1100 producing oil wells had been completed. Estimated ultimate development ranges from 5000 to 6000 wells with most on 80-acre spacing but with some on 160-acre spacing. Indicated recoverable reserves are on the order of 2 billion barrels, based on 25 percent recovery.

Development will be spread over five to ten years, with total production expected to remain fairly constant after it reaches a level of around 100,000 barrels per day due to the decline balancing the effect of new completions. Drilling rate was expected to go ahead at a rate of from about 600 to 1000 wells per year.

Principal operators are Mobil Oil, Seaboard, Stanolind, Great Plains, Tennessee Gas Transmission, Canadian Petrofina, Imperial, Hudson's Bay, Home, California Standard, Baysel.

Joffre Viking sand trend. Joffre field had been expanded to 238 wells by mid-May, and Joffre West now is included in Joffre.

Total length of this Viking sand trend, believed to be continuous, is about 65 miles. Depth ranges from 4800 to 6200 feet across regional dip. Estimated recoverable reserves for the whole group of fields are 100 million barrels. Ultimate development is estimated at about 1000 wells, of which 300 have been completed. It presently is the second most active development area in Alberta.

• Alhambra field lies 25 miles southeast of Pembina field. Discovery well was completed Nov. 30, 1954. Operators: Amerada Petroleum and The California Standard Company.

Field as presently defined covers 19,000 acres; ultimate development, 100-plus wells on 160-acre spacing; Cardium sand; average net pay is 7 feet; depth 6500 feet; estimated recoverable reserves, not including allowance for new extension, 50 million barrels. Operators: Texaco Exploration and McColl-Frontenac Oil Company Limited.

• Ferrier field is located 40 miles south of Pembina field. Discovery well was completed on Jan. 30, 1955, at 9663 feet. Operators are Southern Production Company, Inc., and Pacific Petroleums Ltd. No estimate has been made of reserves, but it is significant as most westerly Viking sand field in Alberta. Three wells are producing.

• Sundre: Located 70 miles northwest of Calgary. Discovery well completed Jan. 10, 1955, at 11,346 feet. Total estimated recoverable reserves is put at 10 million barrels. Operator: Hudson's Bay Oil and Gas Company Limited.

• Westward Ho: Five miles southeast of Sundre field. Discovery well completed Feb. 20, 1955, at 8955 feet. Total estimated recoverable reserves 40 million barrels. Operators: Hudson's Bay, Oilwell Operators, Home Oil, Calgary & Edmonton Corp. Ltd., Shell, Canadian Superior.

• Harmattan: Five miles south of Westward Ho field. Discovery well completed Dec. 16, 1955, at 9280 feet. Estimated recoverable reserves 10 million barrels. Operators: Home, Calgary & Edmonton, Shell, Canadian Superior, Hudson's Bay.

Promising One-Well Discoveries. Individual well discoveries, which are very promising but impossible to evaluate in terms of probable development rate and ultimate reserves, include the following:

1. Red Earth Creek: Discovery well completed Feb. 4, 1956, at 4797 feet, with initial production of 800 barrels a day of 38-gravity crude. Location is 220 miles northwest of Edmonton, the producing formation is Granite Wash. Operator: Union Oil Company of California.

2. Pembina River: 20 miles southwest of the nearest portion of the Pembina oil field. Discovery well completed Feb. 22, 1956, at 8408 feet, with initial yield of 143 barrels daily of 44-gravity crude.

Although no new fields were discovered in the area during 1955 and the first half of 1956, drilling continued at a fairly steady pace in the Sturgeon Lake and Sturgeon Lake South fields. At the end of May, 18 wells were producing in the Sturgeon Lake field and 53 in the Sturgeon Lake South field, while five producers were the total count for Little Smoky. Estimated recoverable reserves are: 20 million barrels in Sturgeon Lake, 100 million barrels in Sturgeon Lake South, and 2 million barrels in Little Smoky. The recently completed Peace River pipe line provides an economical outlet to the Trans Mountain pipe line system, but ultimate production peak under Alberta proration may not exceed 15,000 barrels daily for at least the first five or six years. Principal operators are: Amerada, Hudson's Bay, Union, Imperial, Shell, Texaco, Liberal Pete and Canadian Gulf.

Gas Outlets Awaited. Natural gas discoveries of the past 18 months have been spread literally all over Alberta, but most of them are not in a position to be sure of markets for a long time to come. The only ones that will be mentioned here are those which have markets in sight within at least the next two years.

• Alexander Indian Reserve: 25 miles northwest of Edmonton, was discovered Dec. 10, 1954, at 4270 feet. Estimated recoverable reserves are in excess of 300 million cubic feet.

• Atlee-Buffalo, extension well, 4½

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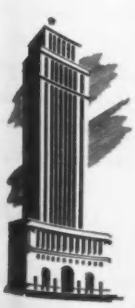

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miles southwest of one discovery well and south of another, was completed Jan. 16, 1955, at 3245 feet in Bow Island sand. There is no estimate available of recoverable reserves. Field is 50 miles north of Medicine Hat, near the Saskatchewan border. Operators are Canadian Export Gas, Chamberlain, High Crest and Baysel.

• Cessford, extension well, 10 miles north of nearest well in Cessford field, completed Feb. 4, 1956, at 4059 feet. Estimated recovery reserves are 489 billion cubic feet. Principal operator is Canadian Delhi Petroleum Ltd. with Hudson's Bay Oil and Gas Company Limited.

• Beaverhill Lake, 25 miles east of Edmonton, discovered in 1953, was extended by two wildcats in January, 1955, and on Jan. 1, 1956. No estimate of reserves has been made. Principal operators are Colorado Oil and Gas Company, L. B. Oils Ltd., Great Plains and Triad.

• Nevis: 100 miles southeast of Edmonton, discovered in 1952, was extended by two wells on June 13, 1955, and on April 10, 1955. Estimated recoverable reserves are put at 613.5 billion cubic feet. Operator is Home Oil Limited with Canadian Gulf Oil Company.

• Kevisville, a wet gas discovery which cannot yet be evaluated. It may be a new field in the Devonian reef trend southwest of Leduc. Discovery well was completed Feb. 27, 1956, at 10,060 feet., in D3 zone of Devonian. Operator is Canadian Gulf Oil Company.

• Tangent, discovered in 1951, was extended an indicated six miles to the east by a well completed May 8, 1956, at 7458 feet as deep wildcat test, plugged back to 2,820 feet, with 15 foot net pay zone in Triassic and Jurassic formations. The Tangent field, as defined, contains an estimated 218.8 billion cubic feet of recoverable reserves.

SASKATCHEWAN. The highest discovery rate for wildcatting experienced almost anywhere in the world was chalked up in southeastern Saskatchewan in the period from early winter of 1954-1955 to the first half of 1956, and indications point toward a continuation of this trend for an indefinite period.

In 1955 the discovery ratio was better than one in three, with 19 oil discoveries resulting from 34 wilcats drilled, in an area 40 miles north and south, by 100 miles east and west, parallel to the Manitoba and North Dakota borders, respectively. Included among these fields are the following:

• Steelman, 30 miles southeast of the Midale oil field, was discovered on Jan. 22, 1955, at 6025 feet, with initial production of 264 barrels daily of 35 gravity crude. Sixty-one wells were capable of producing at May 31, 1956. Recoverable reserves were estimated at 50 million barrels. Operators are principally Imperial, Sun, Canadian Gulf, Canadian Devonian, Canadian Superior, British American and Union of California.

An extension two and one-half miles southeast was made on Jan. 22, 1956, at 5110 feet.

• Lampman, 25 miles east of the Midale oil field, was discovered on Dec. 12, 1954, at 7607 feet, with 100 barrel-a-day production. Estimated recoverable reserves were put at 5 million barrels. Principal operators are Canadian Gulf, Canadian Devonian, Imperial Oil and Sun Oil.

Several important step-out wells have been completed between the Steelman field and the Frobisher field (an early 1954 discovery), and these eight wells appear to link the two fields. If they prove to be a single accumulation, the recoverable reserves of the combined field would be substantially in excess of 100 million barrels. Additional major operators will include Dome Exploration.

• Nottingham, 70 miles southeast of the Midale oil field; discovered Dec. 2, 1954, at 3625 feet. Extension discovery well was completed Feb. 4, 1955, at 3925 feet.

Extension well was completed July 23, 1955, at 3931 feet, 4 miles southeast of the first discovery well. Although not determined conclusively as being part of the same structure, it was included in the field by definition by government order. Principal operators: Imperial, Mobil-Woodley-Southern, Canadian Superior and British American. Estimated recoverable reserves are 30 million barrels.

• Alida, five miles northwest of the Nottingham field, was discovered Nov. 3, 1954, at 3774 feet. Estimated recoverable reserves are 15 million barrels. Principal operators are Imperial, Mobil-Woodley-Southern and Sun.

Extension discovery was completed Dec. 26, 1955, at 3781 feet, 2 miles northwest.

• Hastings, a dual area field, is immediately west of Nottingham and south of Alida. The northeast pool was discovered Sept. 11, 1955, at 4200 feet. The southwest pool was found June 19, 1955, at 4500 feet. Estimated recoverable reserves are 5 million barrels. Principal operators are Imperial and Gridoil.

• Kingsford, another dual area field, is 30 miles southeast of the Midale field. The west pool was discovered July 21, 1955, and the east pool Aug. 11, 1955. Estimated recoverable reserves are 3 million barrels. Principal operators are Orecan Oils, Shell, British American, Union of California, Thomas W. Leach and Sun Oil.

• Weyburn, 15 miles west of the Midale field, was discovered Dec. 17, 1954, at 5124 feet. Extension discovery was completed June 13, 1955, at 5191 feet, 4 miles southeast of first discovery. Estimated recoverable reserves are 20 million barrels. Principal operators: Central Leduc, Del Rio Producers, and Trans Empire.

• Halbrite, between the Midale and Weyburn oil fields, was discovered by two wells completed on Sept. 1, 1955, at 4812 feet, and Oct. 13, 1955, at 4776 feet. Shell is sole operator. No estimate of reserves was available.

• Battrum, ten miles northeast of the Fosterton oil field in the southwest sector, was discovered Feb. 3, 1955, at 3141 feet. Estimated recoverable reserves were put at 21.5 million barrels. Mobil Oil, Woodley and Southern Production are sole operators.

• Verlo, seven miles southwest of the Fosterton oil field, was discovered April 29, 1956, at 3450 feet, Mobil Oil, Woodley and Southern Production are the sole operators. No estimate of reserves was available.

MANITOBA. Only three new oil fields were discovered in Manitoba in 1955 and the first half of 1956, although several other individual well discoveries were made. The ratio for all types of discoveries in 1955 was 10 out of 54 wildcats drilled.

Manitoba drilling slumped in the first five months of 1956, but with a

large wildcat program lined up for the summer season it was likely to wind up the year with about the same number of new wells as last year's 359, with perhaps a little increase in wildcats and a moderate decline in development wells. One new major field discovery was needed to sustain development drilling and production rates.

• Maples, three miles southwest of the Virden-Roselea field was discovered on Feb. 16, 1955, at 2240 feet. No estimate of reserves was available. Operators are Imperial and Sun.

• Routledge, five miles southeast of the Virden-Roselea oil field, was discovered May 25, 1955, at 2080 feet. No estimate of reserves was available. Operators are McCarty & Coleman, Imperial and Shell.

• West Butler, six miles west of the Daly oil field, was discovered November 3, 1955, at 3031 feet. Operator is The California Standard Company.

BRITISH COLUMBIA. British Columbia discoveries in the past year and a half have been entirely of natural gas, with some significant strikes which have added to existing fields and indicated the start of some new fields, although the latter have occurred too recently for evaluation.

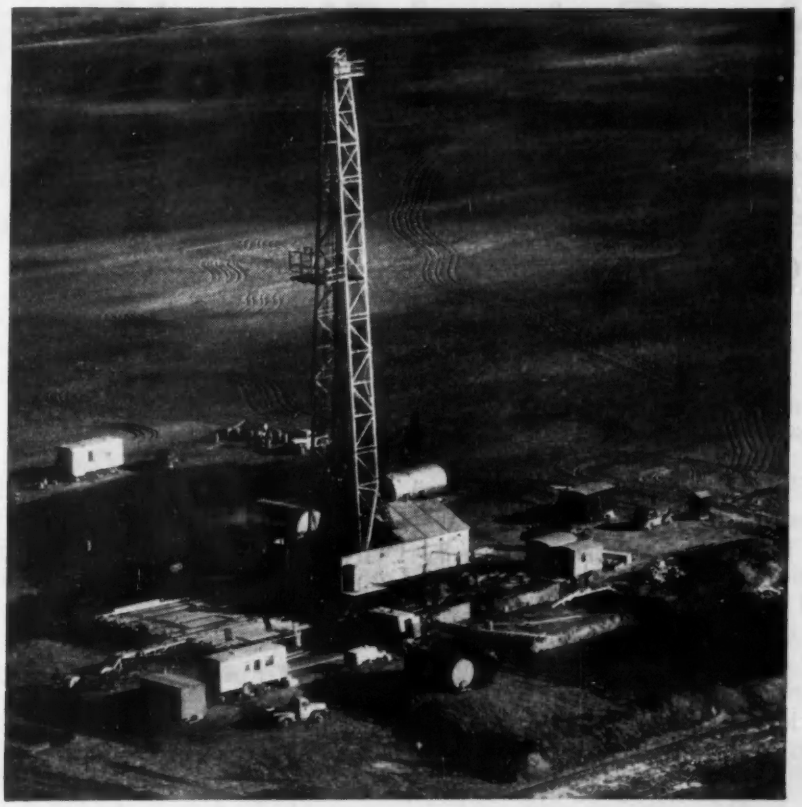
• Nig Creek, 50 miles northwest of the Fort St. John gas field, was extended four miles northeast of the discovery well by test completed April 20, 1955, at 4970 feet. Operators are Texaco, Canadian Gulf (now British American), Shell and Mobil Oil.

• Blueberry River, 40 to 50 miles northwest of Fort St. John gas field, was extended eight miles on May 7, 1955, by well drilled to 7475 feet. Operator is Canada Southern Petroleum Ltd. on farmout from Sun Oil Company.

• Dawson Creek, 30 miles southeast of Fort St. John gas field: discovery well may have extended South Pouce Coupe gas field by eight miles to west. Well was not finished drilling at end of May, 1956, but had given flow of 3.2 Mmcf daily on drillstem test.

• Halfway Lake, 22 miles west of Fort St. John gas field, was discovered Dec. 31, 1954, at 4114 feet. Extension and zone discovery well was completed March 1, 1956, at 7769 feet.

Shadows spell wealth on Canadian prairies



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SPECIAL REPORT

From Behind the Iron Curtain

How Oil Production in Russia Has Gained Since World War II

Banner year in 1955 pushes total production to all-time high of more than 514 million barrels. Here are facts and figures gathered by a special representative of WORLD OIL on a trip to Russia.

By DR. J. BRIAN EBY,
Special Editorial Representative, WORLD OIL

USSR OIL PRODUCTION has gained steadily year by year since World War II. An especially large increase was achieved during the past year.

These gains pushed Russian oil production, which includes both crude oil and liquid hydrocarbons, to an all-time high of 514⅓ million barrels during 1955, a daily average of 1,409,300 barrels. This constituted a daily increase of 229,000 barrels, or 19 percent, over the production in 1954.

The volume produced in 1955 was almost double the 1950 daily average of 754,000 barrels, and was four times larger than production in 1945. The quantity produced in 1945 amounted to only 386,200 barrels daily, a sharp decrease from the 617,800 barrels per day for 1940.

Each year since 1945 has seen production exceed that of the previous year. Production surpassed 1 million barrels a day for the first time in 1953.

Production figures published here were obtained from Soviet government sources (Narodnoe Khozyaistvo, U.S.S.R., 1956, P. 69) in Moscow. Despite the Russian government's silence on oil development during the past 15 years, the figures obtained in Moscow agreed fairly closely with data that have been estimated by U. S. sources.

For example, WORLD OIL's (Feb. 15, 1956, issue) annual production figure of 411 million barrels for 1954 compared with those from Russia of 430¾ million barrels. Again, WORLD OIL's figure of 505 million barrels for 1955 contrasted with the Soviet figure of 514⅓ million barrels. There were some larger discrepancies for some earlier years.

This is the first of a series of articles on the Russian oil industry written by Dr. J. Brian Eby, internationally known geologist of Houston, who recently completed a trip to the Soviet Union as a special editorial representative of *World Oil*.

During his three-week visit in the USSR—his fifth international trip for *World Oil*—Dr. Eby obtained a wealth of information on the Soviet's oil industry. He contacted officials of the various oil trusts, studied exploratory, drilling and producing methods.

This article on Russian production, oil field discoveries and natural gas expansion in Russia is based on the information Dr. Eby obtained at Moscow from government sources. Other stories by Dr. Eby will appear in subsequent issues of *World Oil*.

U. S. Far Surpasses. Despite the big increases achieved, Russian oil production is still far less than that of the U. S. The U. S. produced an average of 6¾ million barrels daily, five times more than the Soviet Union. Texas produced twice as much oil as did Russia during 1955.

Between the years 1945 and 1955, Russia's oil production increased by slightly over 1 million barrels per day. During this same period of time, U. S. production was advancing by 2 million barrels daily.

Gain Due to Ural-Volga Fields. Practically all the increase in Russia's oil production has come from Federated Soviet Republic, known as R. S. F. S. R. This is a vast region. The principal producing fields are the Ural-Volga, although there are other producing areas or fields in the region. Important new discoveries have been made in this area in recent years.

Production of the R. S. F. S. R. averaged just under 1 million barrels daily in 1955, accounting for two-thirds of the country's oil. In 1950 the production of this area was only 362,900 barrels daily, or just over half of the entire country's output for the year.

Since 1950 total Russian daily production has increased by 655,000 barrels, and the R. S. F. S. R. has contributed 618,000 barrels of this amount. Production of this Republic in 1955 was 220,000 barrels per day greater than in 1954. National production in 1955 was but 229,000 barrels a day higher than in 1954.

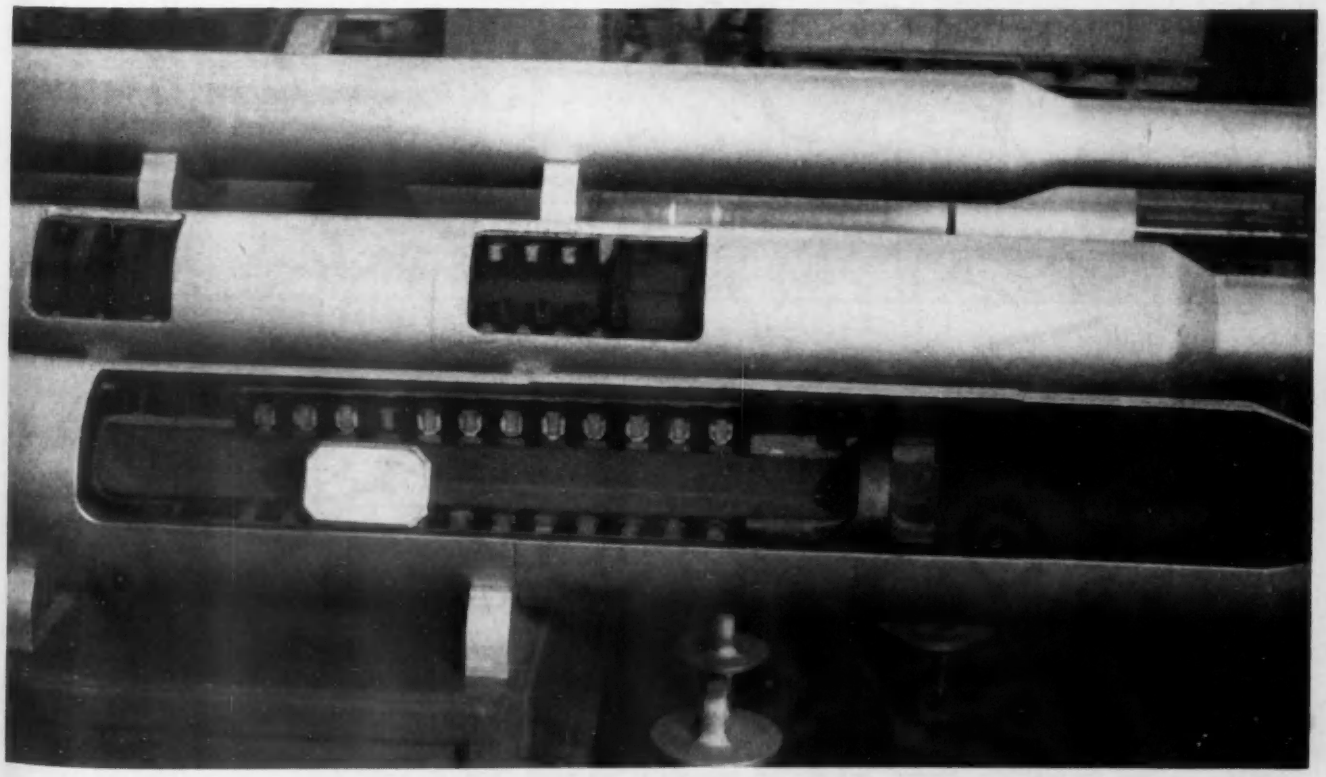
In contrast with its production 980,600 barrels daily in 1955, the R.S.F.S. Republic produced only 139,700 barrels per day in 1940.

Russia's Oil Production Shows Big Gain . . . But United States Continues To Far Outrank

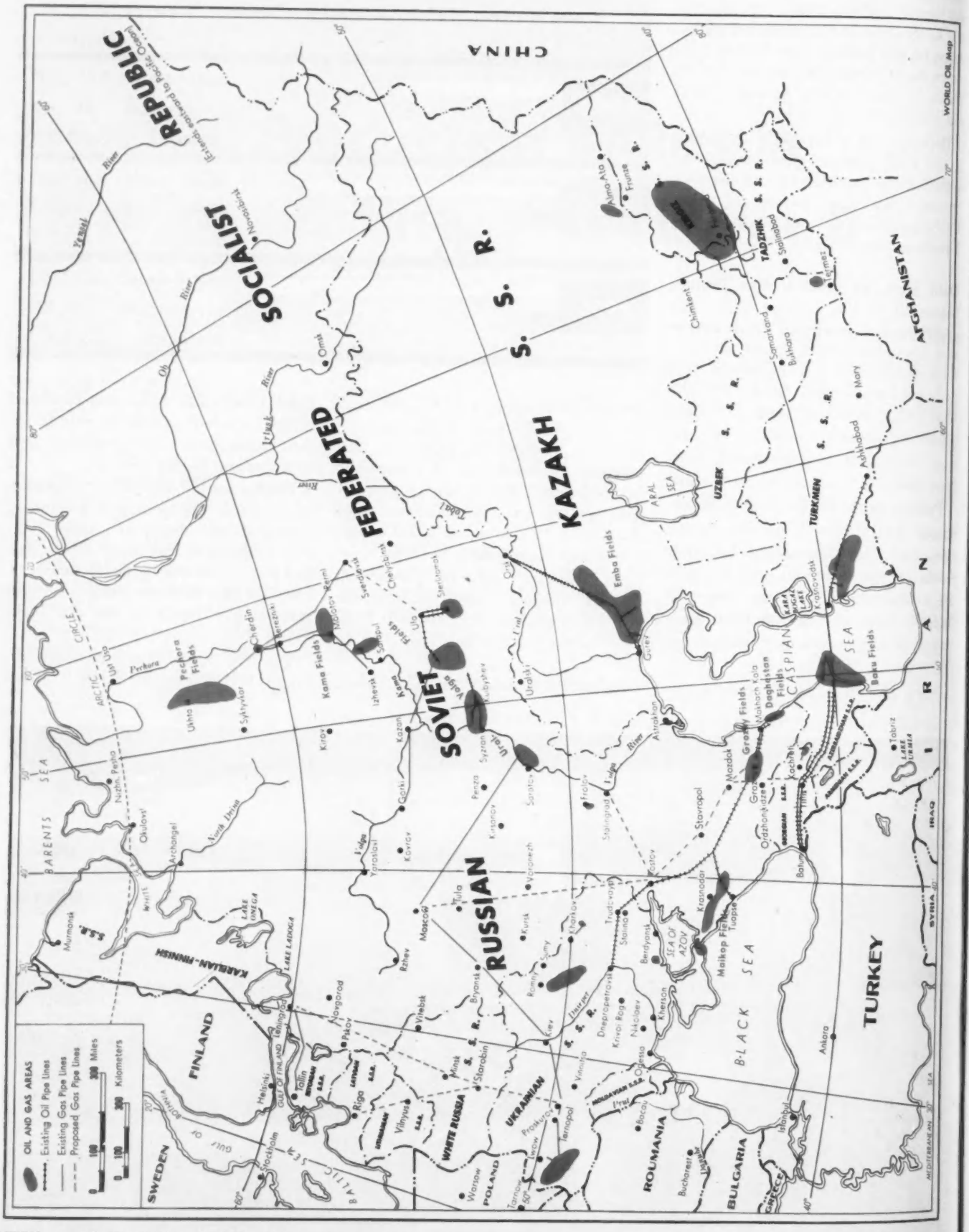
Less Baku Production. The famed Baku producing region has managed to hold a steady producing rate in recent years, although producing less than before World War II.

Production of Azerbaijan Republic, of which is the principal producing area, has held steady at around 300,000 barrels per day since 1950. This has been achieved by development of Caspian Sea offshore production and reworking of wells in the old Baku fields.

In 1940 production from Baku averaged 441,000 barrels daily. This ac-



This is an open view of the Russian turbo-drill on exhibit at Moscow.



RUSSIA . . . The Ural-Volga oil fields, the so-called 'Second Baku,' comprise the major producing area of the Federated Soviet Republic which is responsible for almost all the increase in Russian crude output. Important new discoveries have been made in this area in recent years.

counted for two-thirds of Russia's production for that year. Today's production of Baku is slightly over one-fifth of the country's total.

Of other 14 republics forming the present USSR only 7 produce oil.

Small amounts are produced in the Ukrainian and Georgian republics in the European sector. The other five producing republics are in Asia.

More Asiatic Production. Some gains in production have been achieved in Asiatic republics, although output is relatively small. Total production of five producing republics in Asia averaged 112,500 barrels daily in 1955, compared with 89,300 barrels in 1950 and but 28,900 barrels in 1940.

Half of the Asiatic production comes from Turkmen Republic, immediately west of the Caspian Sea. This area has ranked second to R.S.F.S.R. in gain. It produced 62,200 barrels daily in 1955, compared with 40,000 barrels in 1950 and only 11,600 barrels in 1940.

Kazakh Republic, partly in Europe but mostly in Asia, is the fourth largest producing republic of the Soviet Union. It includes the well known Emba basin salt dome fields.

Production of Kazakh averaged 27,800 barrels daily in 1955, compared with 21,000 barrels in 1950 and 13,800 barrels in 1940.

All other Soviet republics produce less than 20,000 barrels per day.

YEARLY PETROLEUM PRODUCTION GROWTH IN THE USSR

	Barrels Annually	Barrels Daily
1940	226,125,000	617,800
1945	140,960,000	386,200
1946	157,672,000	432,000
1947	188,916,000	517,600
1948	212,167,000	579,700
1949	242,684,000	664,900
1950	275,221,000	754,000
1951	307,352,000	842,100
1952	343,682,000	939,000
1953	383,645,000	1,051,100
1954	430,735,000	1,180,100
1955	514,381,000	1,409,300

Here Are Recent Oil Field Discoveries in Soviet Union

NEW AND EXTREMELY important discoveries of oil and gas have been made in the Soviet Union within the last several years. Of greatest importance are those of the Ural-Volga region, 1000 miles east of Moscow in the vicinity of Ufa, a mainline city and stopover on the Moscow-Transiberian airways.

The town of Oktyabrski lies in the center of a producing area that may well be larger than the East Texas field. Oktyabrski lies about 20 miles southwest of Tuimazy, a town wihch, in turn, lies west of Ufa. Tuimazy is the present terminal of a railroad connection with Ufa. Since 1951 to the present Oktyabrski has grown from a village to an oil city of over 100,000 population. Both Oktyabrski and Tuimazy lie in the Kuibyshev Region (political subdivision).

U.S.S.R Petroleum Production by Areas

	BARRELS DAILY				BARRELS ANNUALLY			
	1940	1950	1954	1955	1940	1950	1954	1955
EUROPEAN REPUBLICS:								
Federated Republics (Ural, Volga, Kama and Pechora fields)	139,740	362,920	760,600	980,652	51,145,000	132,466,000	277,619,000	357,938,000
Azerbaidzhan (Baku fields)	441,342	295,060	303,400	304,674	161,531,000	107,697,000	110,741,000	111,206,000
Ukrainian (Inc. former Polish fields)	7,008	5,833	8,260	10,570	2,565,000	2,129,000	3,015,000	3,858,000
Georgian	814	855	1,017	855	298,000	312,000	371,000	312,000
Total European	588,904	664,668	1,073,277	1,296,751	215,539,000	242,604,000	391,746,000	473,314,000
ASIATIC REPUBLICS:								
Kazakh (Incl. Emba fields)	13,836	21,082	27,550	27,811	5,064,000	7,695,000	10,056,000	10,151,000
Kirgiz	475	934	2,189	2,310	174,000	341,000	799,000	843,000
Tadzhik	596	398	318	337	218,000	145,000	116,000	123,000
Turkmen	11,653	40,233	56,973	62,227	4,265,000	14,685,000	20,795,000	22,713,000
Uzbek	2,363	26,715	19,789	19,827	865,000	9,751,000	7,223,000	7,237,000
Total Asiatic	28,923	89,362	106,819	112,512	10,586,000	32,617,000	38,989,000	41,067,000
USSR Total	617,827	754,030	1,180,096	1,409,263	226,125,000	275,221,000	430,735,000	514,381,000

Note the outside stairway on this Soviet standard rotary derrick.

The area of potential production is claimed to reach from the village of Belebei, 30 miles to the southeast of Oktyabrski, to Bugulma, 30 miles to the northwest of Oktyabrski. It also includes the town of Tuimazy and embraces the old oil field of Tumazar, at Tuimazy, which was a pre-World War II oil discovery in Permian rocks. The potential area of production is said to be approximately 60 miles long and 30 miles wide, a truly great field.

The small Permian oil field at Tuimazy was producing for many years from two sandstones found at a depth of 3558 feet. Below these beds occur rocks of Upper, Middle and Lower Carboniferous Age (Pennsylvanian and Mississippian in the U.S. geological column). These beds are about 1200 to 1500 feet in thickness and overlie the Devonian formations which is topped by an extremely hard dolomite.

For many years this dolomite resisted the efforts of the Russian driller and led indirectly to an intense concentration in the development of the turbo-drill, to penetrate this formation. The Russian design of the new turbo-drill using hard rubber seats for the rotating bit, instead of metal, as heretofore used experimentally, succeeded very capably in cutting the hardest rock and led directly to the discovery of immense new reservoirs of oil and gas in three or four sands of the Tulsky formation of the Devonian at Oktyabrski.

The top sand was found at 5400 feet depth and contains a high gravity oil, rich in casing head gas, but of low oil and gas ratio. The oil compares favorably with the Cretaceous oil of the East Texas field. The oil is pumped to Ufa and thence sent by rail to refineries at Kuibyshev and Leningrad. Gas from the Devonian field is now being used to repressure the older Permian wells in the Tuimazy area.

Naturally, the Soviet geologists are relucant to discuss the details of their fields prior to Russian publication and it is difficult to obtain the detailed information outside to discuss the relative importance of this discovery with comparative fields elsewhere in the world. However, it is reported that there are over 300 rigs in the field and well spacing on the order of one well per two square miles. Seventy to 80 percent of all the wells now drilled in the Soviet Union claim to use the turbodrill, but here the turbodrill is used entirely.

Several other discoveries are mentioned by Dr. M. F. Mirchink, corresponding member of the Russian Academy of Science, and chief geologist in charge of the Oil Geology Division of the Academy of Science in the Ministry of Oil for the Soviet Union. Dr. Mirchink, writing in a recent issue of *Oil Economy*, a monthly Soviet oil magazine, points to a large expansion of the Romashkino oil field, due north of Ufa about 100 miles. This would indicate a location near the town of Sarapul, midway between the Kama river and Ural-Volga fields. Still further north and almost midway between Molotov (old city of Perm) and Ufa, new oil discoveries of oil and gas were made in both Carboniferous and Devonian rocks in the Elzbughy district north of the Kama river. These are in the Tatar Republic and insure much additional exploration here.

The discovery of the big Shkapovsky oil field in the southwest part of the Baskhir Republic in the Belebei district found oil in rocks of Lower Carboniferous age. Several other smaller fields are mentioned in the Bashkir Republic such as Leonidovka, Koustantinovka, Chekmagush, Arlan and others, but the writer is unable to locate them.

The most important recent discovery in the Kuibyshev region is the Muhanovsky oil field on the left (west) bank of the Volga near Kuibyshev (In Russian literature the *left* bank of any river is the bank on the left hand of a person facing *downstream*).

In the Lower Volga region, near Saratov, oil was discovered in 1954 and 1955 on the west bank of the Volga. The field is called the Stepanovsky oil and gas field and is in Devonian rocks. On the west bank in the Saratov region, fields of lesser importance were recently discovered, for example, Guselka, Goruchkinskoe, Bogaerskoe and others.

In the Stalingrad area oil and gas is now being produced at Jirnoe and Bachmatjer oil fields. Two new recent discoveries have been made at Korobky and Linero, all the oil coming from rocks of Lower and Middle Carboniferous. The Devonian in the Stalingrad area has not yet been explored.

As the production figures indicate

the Ural-Volga oil producing area is accounting for all the increased production in the Soviet Union in 1955 over 1954. From all reports the so-called "Second Baku" area is no idle jest. The name is said to have been coined by Stalin a couple of years before he died. The fact is it may well be one of the world's most important oil-producing areas, comparable to Arabia and Iran.

An interesting development in the Grozny area of the north Caucasus area was the discovery of a new oil field on the Nogai Steppe, in rocks of Cretaceous-Jurassic age. This was strictly a geological-geophysical discovery and dates from April, 1956. The field has been named the Ozeksuat oil field.

Big Natural Gas Expansion Planned in Soviet Union

THE INDUSTRIALIZATION program of the Soviet Union will make ample provision for the expansion of its natural gas resources. At the end of 1955, some 53 towns and cities of Russia were supplied with natural gas.

The plans for the 1956-60 Five-Year program calls for 46 more cities to be supplied with natural gas. This means that whereas in 1955 the Soviet Union was using 10,000,000 cubic meters (353MMcf) annually, by 1960 the production of gas will have to be increased to 40,000,000 cubic meters (1.4 billion cubic feet) per year.

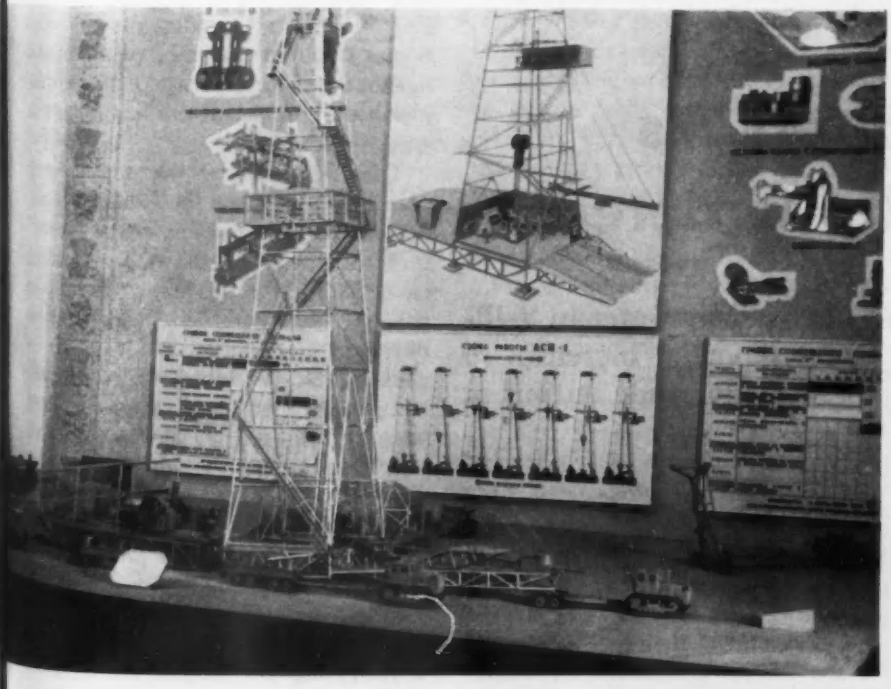
The most important line now building is from Moscow to Stavropol on the north side of the Caucasus Mountains and northeast of the Maikop oil fields. This line will be 1310 kilometers (814 miles) long and of 700 millimeters (28 inches) in diameter. It will contain five major pumping stations.

It is planned to continue this line to Grozny and also have a spur over the Caucasus to Tbilisi in the Georgian Republic.

Another major project will be the building of a gas line from Leningrad south to Ternopol. A branch of this line will leave the main line near Starobin and head northwesterly to Vilnyus and terminate at Riga on the Baltic Sea.

From Rostov on the Don river two lines will extend, one northeast to Stalingrad and one due south to Krasnodar.

A line from Astrakhan to Gurev on the north shore of the Caspian Sea is also in the program.



This is a model of a Russian portable derrick and rig. Three tractors are used to pull the derrick (right) and three are used to pull the rotary table and drawworks (left).

WHERE IS RUSSIAN OIL?

THE SOVIET UNION (the USSR) containing over 200 million people, speaking 80 languages, administratively is divided into 16 Soviet Socialist Republics. What is commonly referred to as the "original Russia" is the No. 1 member and known as the Russian Soviet Federated Socialist Republic (the R.S.F.S.R.) which, in turn, is comprised of 12 autonomous republics and approximately 30 regions. The areas known as "regions" are controlled directly by Moscow.

The following tabular listing of these various administrative units, showing those containing oil, will be helpful in locating the various oil-bearing areas of Russia.

THE SOVIET UNION

- • **1. Russian Soviet Federated Socialist Republic (including about 30 regions in addition to republics):**
  - •**Tatar Republic**
  - **North Osetia Republic**
  - •**Dagestan Republic**
  - •**Bashkir Republic**
  - **Buriat-Mongolsky Republic**
  - **Kabardinsky Republic**
  - **Komi Republic**
  - **Maryiskaya Republic**
  - **Mordorsky Republic**
  - **Udmurtsky Republic**
  - **Chuvashsky Republic**
  - **Iakutsky Republic**
- • **2. Ukranian S. S. R.**
- **3. Byelorussian S. S. R. (White Russia)**
- • **4. Kazakh S. S. R.**
- • **5. Uzbek S. S. R.**
- • **6. Tadzhik S. S. R.**
- • **7. Turkmen S. S. R.**
- • **8. Kirgiz S. S. R.**
- • **9. Georgian S. S. R.**
- **10. Armenian S. S. R.**
- • **11. Azerbaidzhan S. S. R.**
- **12. Lithuanian S. S. R.**
- **13. Latvian**
- **14. Estonian S. S. R.**
- **15. Moldavian S. S. R.**
- **16. Karelian-Finnish S. S. R.**

•**Oil-Producing Region**

SPECIAL REPORT
continued

Well at Servo, in the second Baku area.

Russian Plan Falters As Drilling Speed-Up Ordered

New turbodrill and use of clear water in drilling through hard formations bring reported increases in penetration rates. One source pegs USSR crude output at 1.4 million barrels a day.

THE USSR COMPLETED its fifth Five-Year Plan on Dec. 31, 1955 (see New Soviet Five-Year Plan, Page 185). Ever since the first government production plan in 1928, the Communist Party of Russia has written "Directives for the Development of the National Economy" which, after party approval, have been passed on as orders to the Soviet government. With every important branch of Soviet economy being a state undertaking, the government merely issues orders to the specific companies, or trusts.

Status of the Communist party as virtually the only policy-maker in Russia has been maintained since the October revolution, though various groups won more influence during the past periods—such as the secret police under Beria and, more recently, the Red Army under Bulganin).

These influences, however, did not alter the original Soviet viewpoint that heavy industry was to have priority over all other branches of national economy. Within this group, the oil industry is, perhaps, the most successful.

Expanded exploration activity led the Soviet oil industry to discoveries in the Second Baku area both in prewar and postwar years which made the revision of the original crude production targets for 1955 possible. The late Marshal Stalin ordered 1955 production level to reach 72,660,000 barrels over the original 435,960,000-barrel quota—or 508,620,000 barrels. And it appeared reasonably certain, if Soviet claims are correct, that the higher objective had been reached.

Dr. J. Brian Eby, WORLD OIL representative and consulting geologist, Houston, Texas, reported production of oil in 1955 amounted to 514,432,800 barrels, or 1.4 million barrels a day. He obtained this figure during a visit to Russia from which he returned in July (see Page 174).

Organization of the Soviet oil industry is government at the top level by the Ministry of Soviet Oil Industry. Regionally, the industry is divided into the various Socialist Soviet Republics or Autonomous Socialist Soviet Republics. Within these republican undertakings, trusts—or companies—are established according to the specified work area.

The government, when receiving plan directives from the Central Committee of the Communist party "votes" these directives into laws and assigns each state a specific goal, whereupon the individual companies receive their orders.

In many instances, however, the companies themselves after detailed studies pledge higher production. The over-all fulfillment of the Russian oil plan cannot cover up the fact that some of the republican enterprises did not fulfill even the basic plan requirements.

Drilling. The drilling quota of the industry was not fulfilled during 1955, 1954 or 1953. Drilling footage, however, did increase from year to year.

The Soviet Statistical Office has not revealed any actual figures on drilling. In various speeches by Soviet ministers, detailed percentages and sometimes actual figures have been released. For example, the Tatrian Soviet Socialist Republic is reported to have drilled a total of 5,940,000 feet, including both development and exploratory efforts. During the current Five-Year Plan (1956-1960), the republic is scheduled to drill 17,820,000 feet.

In 1949 the USSR announced that during 1950 five times the prewar exploration footage would be drilled and that during 1949 a 58 percent increase in footage over 1948 was recorded. Manufacture of drilling equipment rose during 1949 by 40.5 percent from the 1948 level.

New methods and new equipment were credited with having boosted 1951 drilling rate by 43 percent over that of 1950. Another increase in drilling rate was recorded during 1952, when 30 percent higher commercial drilling speeds were noted as compared with 1952. An increase in total footage drilled—amounting to 73 percent—was claimed for 1953. The utilization of bits rose by 77 percent from 1952.

Eleven times the 1952 exploration drilling footage was reported for 1953. Still another report mentioned a 250 percent increase in total drilling footage from 1950 to 1954.

The Azerbaijan Petroleum Ministry's chief technical engineer said on Dec. 9, 1955: A 17 percent surplus in exploratory drilling was achieved over the plan. The drilling speed for turbodrilling was increased by 15 percent, the general well drilling rate rose between 15 and 20 percent. To "save" Baku, the Azerbaijan Oil Trusts in 1952 drilled five times as much exploratory footage and 2.8 times the prewar production footage.

Bulganin Demand. Premier Bulganin in July, 1955, demanded "mechanization of derrick erection and dismantling, increased use of turbines and higher drilling speeds." The Statistical Central Bureau of the Council of Ministers of the USSR said that "in the oil industry, speedier drilling systems were more widely used and turbines were more extensively employed, increasing to 83 percent of all drilled footage."

At Ishimbai, in the Second Baku area, 59 percent more exploratory wells were drilled in 1955 than in 1951. (At the same time a 230 percent increase in crude production was claimed from the same area).

This and the following articles discussing Russia and its satellites were prepared by special correspondents and WORLD OIL's staff.

Mikhail Evesejenko, USSR minister of the petroleum industry, explained over Radio Moscow on Nov. 25, 1955: "The most rapid mastery of the new oil deposits depends on the speed with which exploitational wells are drilled, along which the oil rises from the stratum to the surface of the earth. This year, the speed of exploitational drilling has increased two- to three-fold, compared with prewar drilling. This has been achieved thanks to the utilization of new technical equipment and of advanced drilling technology.

"The use of turbodrilling also has improved the technology of drilling inclined (directional) wells. Mechanical speed of drilling reached 23 feet an hour, thanks to the use of turbodrilling."

The sixth Five-Year Plan demands an "85 percent increase in drilling production wells, and an average of 90 percent in drilling exploration wells. Cost of drilling is to be reduced by at least 30 percent."

The Azerbaijan Oil Ministry recently said of the area's 1956 drilling program: "Despite improvements in 1955, drilling work is one of the most backward fields. Prospecting drilling costs are very high. Greater productivity from this work is neglected. During the new year, we must reduce drilling costs considerably and see that the increase in drilling speed is a factor for reducing the cost. We lag considerably in mechanical speed of drilling compared with other regions, although our soil is no worse than that of other regions. This shows that we have shortcomings in the perfection of drilling techniques and do not fully use existing equipment.

"The most important task of 1956 is the increased use of turbodrilling to cover 70 percent of total drilling."

Drilling Rates. The Stalingrad Oil Trust announced on March 26, 1956, that "the volume of deep drilling will be about four times as great as under the previous Five-Year Plan. Drilling rates are to be increased almost two-fold to reach 2145 feet per rig per month through a series of organizational and technical arrangements."

Comparison between the drilling operations in the Old Baku area and the Second Baku region point up the fact that Second Baku wells are only 33 percent to 50 percent as deep as the former—or Azerbaijan—wells. Ufa registers an average of 5775 feet, while Baku area has an average depth of 13,123 feet.

The Ufa field has an average drilling time of three weeks for a 5700-foot well, whereas the prewar level stood at 12 to 17 weeks. Drilling costs at Ufa decreased during 1955 by 30 percent as compared with 1950. Ninety-five percent of all wells are turbodrilled as compared with 59 percent in Old Baku.

Second Baku drilling wears out an average of one bit for each 62 feet of hole due to the hard rock formation. In Old Baku, one bit normally drills 3200 feet, it is reported.

The Soviet Trade Union paper *Trud* said that at Molotov a minimum footage of 6½ feet per bit was normal. To drill one 13,000-foot well in Azerbaijan, eight to nine bits are required. To drill a 5500-foot Ufa well, up to 120 bits are necessary.

The original turbodrill rig, as developed by Kapelushnikov during 1924-1925, has brought about a most decisive change in Soviet drilling. The technique has been altered repeatedly, with the 1955 revision being the Electrowiev system—a direct coupling between an electric motor and turbodrill bit.

New Turbodrill. On Nov. 9, 1954, Nikolai Baibakov, USSR petroleum minister, announced that a "turbine driller of a design new in its principle is at present being subjected to industrial testing at the oil fields of Bashkiria. This design makes it possible to substantially increase the period of service of the mechanism and the chisel work performance."

By applying perfected drilling technology and machinery, the oil industry has achieved high speeds in drilling. For example, in the Tatar Republic the records purport to show a drilling rate of 10,000 feet per rig per month and in Azerbaijan 14,800 feet.

Another decisive method in speeding up drilling is the use of clear water

in drilling through hard formations. Unusable where soft formations predominate, replacement of drilling mud by water has reportedly shown significant results. The first announcement came from Minister Eveseyenko, who said June 19, 1953:

"Drilling competition raised the average drilling speed of 3937 feet per rig per month in the eastern areas to 7418 feet in the Tatar oil trusts. This has been made possible by the introduction of water as a flushing liquid, replacing mud solutions. Water does not contain any sand or particles of drilled ground which affect the working tools and equipment. Therefore, the serviceable life of the instruments is considerably prolonged and the expensive spare parts requirements are almost cut to 50 percent."

Another Russian source said "clear water flushing brings about an increase in the specific output of the rig by 75 percent, reduction of wear and tear at pumps and tools up to 50 percent, a drilling speed increase of up to 73 percent, and reduction of drilling cost to $8.75 per foot."

However, Professor Shazev of the Academy of Science, who serves as head of the Moscow Oil Institute, is reported to have expressed doubts about the universal and general application of this process. In an article in *Pravda,* Shazev was most reserved about the method even in hard rock formations.

Only one other drilling innovation is being practiced on a wide scale—"dual well" drilling. This practice is described on Page 196.

Production. Tass reported on Dec. 27, 1955: "The oil industry of the USSR fulfilled the 1955 plan for the production of crude on December 18, natural gas on December 2 and light oil products on Dec. 21, 1955. The annual oil production plan was overfulfilled by Azerbaijan, Bashkir, Tatar, and the other large oil regions of the country. Output was 19.4 percent above the corresponding period last year. The biggest increase took place in the Ural-Volga oil fields. Thus, it was 18.4 percent in Bashkir, 52.6 percent in the Tatar republic, 38.8 percent in the Kuibychev region, and 84.5 percent in the Stalingrad region."

It appears that a gap exists in official estimates. Tass said the production plan was fulfilled, which reportedly amounted to 507,893,400 barrels, whereas the 19.4 precent increase over 1954 (when the Central Statistical Bureau of the Council of Ministers of the USSR reported crude output at 422,881,200 barrels) would provide a 1955 total crude production figure of only 497,503,020 barrels.

Postwar production in Russia has been the subject of much controversy, owing to the Soviet secrecy as to actual figures.

Data on Russia's crude production for 1953 (1,045,109 barrels daily) and 1954 (1,158,578 barrels daily) were released by the official Central Statiscal Bureau. The 1955 production figures vary from 1,373,572 barrels a day to 1,433,293 barrels a day, according to news media, statements by Russian leaders, and estimates in the Western press.

The most reasonable estimate from one informed source is 1,373,572 barrels a day, or about 19,800 barrels shy of the 1953-announced Stalin goal.

Consumption. Domestic consumption of oil products in Russia is estimated by the United Nations Economic Bureau to have reached 1,393,479 barrels daily in 1955, according to the planned announcements, while the 1951 figure was 836,088 barrels per day.

Proven crude reserves in 1938 reportedly amounted to 6.4 billion barrels and probably reserves were put at 56.4 billion barrels. Reserves in 1950 were estimated at 32.7 billion barrels and in 1953 the estimate rose to 47.2 billion barrels.

In reporting 1955 reserves, it was claimed that the Second Baku area contains about 36 billion barrels of crude reserves (United Nations estimate: 32.7 billion barrels) as compared with 19.6 billion barrels estimated in 1938.

For the Emba basin area, the only estimate available is one issued in 1935—726.6 million barrels. It is safe to evaluate the Second Baku area as having 32.7 billion barrels of crude reserves, Old Baku with 21.8 billion barrels and other producing areas, such as Emba, Sakalin, etc., with 7.3 billion barrels. Thus, the 1955 total of crude reserves would approximate 61.8 billion barrels based on Russian claims.

Old Baku's reserve figures have increased largely through discoveries offshore in the Caspian Sea (see WORLD OIL, Aug. 15, 1955, page 139) and deeper drilling.

The area-wide development of the Russian oil output cannot be laid down in one complete report, for only fragments of data are available. It appears, however, that Old Baku, which was thought to be on a sharp downtrend from 1945 to 1953, has increased its production through extensive exploration, secondary recovery and expanded turbodrilling.

Old Baku Output. Old Baku's production peak of 557,400 barrels per day during 1939 has not yet been reached; however, the 338,400 barrel daily average during the past eight years appears to have been exceeded.

The Azerbaijan Petroleum Industry ministry said on Dec. 9, 1955, that the annual "obligations were fulfilled on Oct. 22, 1955" and that more than 3,633,000 barrels of oil were produced above the quota.

This early fulfillment indicates—if true—that the crude yield increase actually was bigger during 1955 than the planning offices had expected. Chief of the technical administration of the Azerbaijan ministry said "the volume of turbine drilling was 15 percent higher than during 1954, drilling speed exceeded that of 1954 by between 15 and 20 percent during 1955." Artificial methods of extraction also are in use: 58 horizons are being treated artificially, according to one source, whereby a daily rate of 247,170 Mmcf of water and 1588 Mmcf of compressed air are being pumped into wells each day.

This secondary recovery method has been extended to about 3000 wells. Where during the first 11 months of 1954, a total of 7,571,172 barrels of oil was produced, the Azerbaijan fields produced during the same period of 1955 more than 11,625,600 barrels of oil above the plan.

According to Russian technical sources, the method of breaking up strata was introduced in Baku fields during the middle of 1954. This resulted in production increases of two to three times over the pre-1954 level. At Oil Field No. 1 of the Nefte-promyslovoje Upravlenije (Lenin Oil Administration Trust), a 435,960-barrel surplus production was recorded because of this practice.

In 1956 more than 70 deep-well electric pumps were scheduled to be in operation at the Lenin Trust and

at the Ordzhonikdze Oil Administration.

Also, during 1955 more than 871,920 barrels of additional oil was produced by the acid treatment. The method employs hydrochloric acid.

Successful Trusts. The 1955 Azerbaijan oil report (broadcast over Azerbaijan Regional Service on Jan. 7, 1956) said: "The most successful trusts were Gyurgyan, Molotov, Lenin, Sijazin, Artem, and Kirov. During the first 11 months of 1955, decreased production costs permitted a saving of a reported $12 million.

The most spectacular development was reported in the Second Baku area, where four big trusts—Ufa, Molotov, Kuibyshev, and Saratov—operate (see Table 1).

TABLE 1
Production in Russia's Second Baku Area

Year	Barrels
1929	4360
1932	72,660
1933	254,310
1934	544,950
1935	2,993,592
1936	4,722,900
1937	7,120,680
1938	9,445,800
1939	13,442,100
1940	21,798,000
1946	43,596,000
1947	54,495,000
1950	77,019,600
1952	138,054,000

Annual production reports said that in 1949 Kuibyshev delivered 19 percent of total domestic production, as compared with 7 percent during 1939 and as compared with 33 percent for the 1955 plan.

Second Baku Record. The entire Second Baku area reportedly produced 44 percent of the total 1950 Soviet output as compared with 12 percent during 1940. The official 1950 plan varied between 159,257 barrels a day and 179,162 barrels a day. Production reportedly is greater than the established quota which indicates the unexpected development of one of the four big trusts' fields.

In 1952 Premier Malenkov said 40 percent of the production stemmed from Second Baku, 10 percent from the Emba, Sakalin and Pechora fields.

During 1954, Ufa field reported a 20 percent increase from 1953, Tuimaza (also in Second Baku) reported doubling the 1950 output during 1954 while Saratov announced that during the first third of 1954, production was 30 percent above that recorded during the identical period in 1953.

Stalingrad production doubled during 1954 as compared with 1953, and Grosny (Baku) reported a 13.8 percent increase from 1953. Ishambai (Second Baku) doubled the 1954 yield in 1955.

The new center of the Soviet producing phase is the Second Baku area, where Ufa, Molotov, Kuibyshev and Saratov trusts operate.

Oil fields under the Molotov trust are Gorodki, Verdune-Tshussovsk, Polasna, Seccerokamsk, Krasnokamst, Overiata, and Shilovo.

Ufa trust fields are Ishambaevo, Kusiankul, Smakaevo, Buranchino, Termenjelga, Tuimaza, Allaguvativo, and Kusuinovka.

Kuibyshev trust fields include Sysran, Jablonovo, Kuiel, Buguruslan, and Sultangolovo.

Saratov trust fields are Teplovka, Kundin and Dergaeli.

Stalingrad Region. Tass reported on March 25, 1956, that the Stalingrad region currently was producing more oil than Grozny or the Ukraine. Reportedly, a whole series of major deposits were discovered in the area. Some of the producing wells are yielding more than 300 barrels of oil daily. In addition, the area has been found to contain considerable gas deposits from which one pipe line has been laid and more are being built or projected, since six gas deposits have been made ready for use.

Thirty-two sites have been earmarked for oil and gas prospecting, with about four of them expected to be producing fields. Wells are to be drilled from 6500 feet to 8200 feet and are expected to require three to five months each to drill.

Considerable attention is being paid to the far eastern third of Baku. With Okha as the center, the Sakalin Oil Trust reported on May 17, 1955, that:

"Study and exploration work started as soon as this area was liberated from the Japanese. It was decided to start off from the northernmost part of the island, in Okha region. Oil workers from Baku and Grosny 'followed the call of the Communist party and the Soviet government' to the so far impenetrable marshes. Now, after 30 years, Sakalin boasts cities like Ekhabi, Vostochny, Mosklovo, and Gubkino. The production plans both for 1955 and the entire fifth Soviet Five-Year Plan (1951-1955) were fulfilled. An oil industry technical school was founded there during 1955."

Pipe Lines. This is a subject in the USSR which is simply not discussed. The only late reference to pipe lines was made by Minister Evesenjenko, describing the accomplishments of the fifth Soviet Five-Year Plan (1951 to 1955):

"In recent years very great gas deposits have been discovered in the Ukraine, North Caucasus and the Volga districts. New gas pipe lines have been built and commissioned. The building of trunk gas lines is done in improved ways and more rapidly."

The new Five-Year Plan (1956 to 1960) only demands "acceleration of the tempo and cutting to a minimum the costs of construction of oil refineries and main pipe lines."

The most extensive postwar built pipe line system is reported to exist in the Second Baku area. Molotov trust has about 500 miles of oil and gas lines, Ufa has two lines from Ishambaevo of 100 miles each and one 95-mile main line from Tuimaza to Ufa.

Kuibyshev reports main lines from Jablonovo to Sysran, Sultangulovo to Buguruslan and from Buguruslan to Kuibyshev. Saratov has a gas line with a 7.6 Mmcf. annual capacity to Moscow.

The past Five-Year Plan called for the doubling of principal crude, gas and products pipe lines from the 1950 level. A report reaching the West indicated that 15 percent of the 1952 oil movement was through pipe lines.

A new oil line is under construction connecting the Almetievsk fields in Tatar with Gorki. Pravda reported on March 17, 1956, that crude production in this republic would treble during the next five years. Since even under present conditions railroads cannot manage the speedy transport of oil from the fields, the lack of pipe lines is limiting the supply of oil.

An 807-mile oil pipe line from Tuimazi to Omsk now is operating. When this line was constructed, five rivers had to be crossed. It was put into operation on Jan. 9, 1956.

Completed during 1955 was a gas line from Kiev to Moscow which was prompted by the failure of the Saratov fields to supply sufficient natural gas to Moscow. One oil line is said to exist between the East Siberian fields around Olekma and Tolba, be-

tween the Tolba and Witim rivers, and from southern Baikal lake to a refinery south of Utulik.

Exploration. Soviet press dispatches said during the early postwar years that, up to the outbreak of World War II, only 40.4 percent of Soviet territory was geologically mapped and only in 0.7 percent of Soviet territory was more detailed study work being conducted. Since then, however, exploration has played an important role. The fast development at Second Baku is one visible success of the efforts during the first five postwar years.

Minister Evesejenko said Nov. 25, 1955, via Radio Moscow:

"The growth of oil output depends, first of all, on the successful prospecting for new industrial oil deposits. The broadening of the front of geological research, geophysical and prospecting work in the course of recent years has led to the discovery of several hundred new oil and gas deposits.

"Prospecting work along the Kama river, which has been going on for several years, ended successfully this year. A new oil deposit has been discovered there in Devonian strata. Good results have been achieved from prospecting work in the districts along the Volga (river). Large oil deposits have been discovered in the coal-bearing Devonian strata of the Mukhano field, and they bring Kuibyshev to one of the first places in the country from the point of view of oil deposits.

"Geologists have likewise had big successes in the Volga regions of Stalingrad and Saratov. Large oil and gas deposits have been discovered on the left bank of the Volga and the Kara-Kovskoye deposit in the north of the Stalingrad Trust.

"Much attention has been paid likewise to prospecting in the districts of Azerbaijan, Ukraine, Turkmenia, Kazakhstan, Krasndar-Krai, and Grozny Neft trusts, where large oil and gas deposits have been discovered."

Exploration operations have been reported in the Turkmenia area, in Usbekistan and on Sakalin island since October, 1951. In the Ukraine, natural gas deposits have been discovered near Poltava. Since 1953 exploration work has turned toward Shebelinka, in the Charkov area.

Exploration drilling was reported during mid-1955 in the Dnieper-Donetz basin area, but no results have been made public.

Exploration to Increase. The new Five-Year Plan (1956-1960) demanded a 95 percent increase in exploration drilling. At the same time, drilling costs were to be cut by 30 percent. Crude production plans for the more important oil republic within the Soviet Union indicate extensive exploration work.

New Field Discoveries. On Nov. 25, 1955, Oil Industry Minister Evesejenko said that Kuibyshev-Neft trust reported the discovery of large oil deposits which make Kuibyshev one of the country's major oil sites.

The richest deposits have been discovered within the Volga-Ural oil bearing area, among which is the Shkapovskoje deposit in the southeast Bashkir republic.

Also, oil was found in the Devonian at Mukhanovo, as well as near Saratov in Second Baku and Kara-Kovskoje in northern Stalingrad Trust territory.

Field expansion has been indicated at the field of Romny, near Poltava, Galician fields near Przemysl and Tschernovitz as well as the Siberian trust fields of Aldau, Kangallassy, Olemka, and Tobla.

In Tatar Socialist Soviet Republic, oil was discovered at 3608 feet in Well 23 (Kazhan) along the Shesmar river.

Caspian Sea. Hydroelectric power plants on the Volga, Ural and Kuma rivers reduce the flow of water into the Caspian sea, which is causing a steady drop in the sea level. Consequently, large areas along the shallow coast line are being dried up. Latest reports indicate that 8000 square miles of the Caspian coast bottom has been dried up to reveal formations similar to the Apsheron peninsula—site of the Busowna field in Old Baku.

Six natural gas deposits were made ready for exploitation in the Stalingrad trust area. New deposits also were found in the general area of Savropol. Other deposits have been found near Charkov, Mirgorod, Lubny and in Michailov.

In the south Ural area, an old field has been discovered near Bisikar, and exploitation was scheduled to begin during the second half of last year.

General Economics. Domestic consumption in Russia is believed to amount to between 472 million barrels and 508 million barrels annually, or—on a daily basis—between 1,293,000 barrels and 1,391,000 barrels. However, the per capita demand is extremely low. Automotive vehicles for civilian and private use are scarce and mechanization in agriculture has increased but slightly. The principal customer for products, or course, is the Red Army. Nationalized industry and agriculture follow in order.

While there is no scarcity in the supply of coal, as a primary energy source, Soviet industry is encouraged to use heavy oil products as a replacement for coal. The reason lies in the difficulty of transporting the solid fuel.

Imports and Exports. The Soviet Union exported, according to Western estimates, about 32 million barrels of crude and products during 1954 and 43 million barrels in 1955. Imports of crude products are not known. Probably there were none.

Export agreements have been concluded with the following nations:

- Belgium, to which Russia exported approximately 700,000 barrels of diesel oil on Jan. 29, 1954.
- Finland, which received on Jan. 24, 1955, about 2 million barrels of gasoline, 1.6 million barrels of diesel oil and 240,000 barrels of other crude products. On July 17, 1955, exports to Finland were planned at the level of $20.5 million for 1956 and $23 million in 1960.
- France, which on July 1, 1954, received approximately 5000 barrels of crude and about 725,000 barrels of gasoline.
- Iceland, which on Aug. 1, 1953, signed an agreement whereby Russia would supply its entire petroleum requirements—about 1.5 million barrels annually.
- Italy, which on Feb. 10, 1954, imported crude oil from Russia.
- Norway, which on May 23, 1955, imported an undisclosed quantity of fuel oil.
- Sweden, which on Feb. 3, 1954, was listed as receiving 6.5 million barrels of various oil products.
- United Kingdom, which on March 16, 1954, received its first consignment of Russian oil products since prewar years.
- India received on Dec. 24, 1953, an undisclosed quantity of crude and

crude products. In addition, in October, 1955, the Chelyabinsk Steel Mill was scheduled to deliver pipe for India's refinery.

- Japan received a shipment of Baku crude under terms of a May, 1954, pact.
- Israel imported a shipment on Sept. 3, 1953, and took up an option on another shipment in addition to signing an agreement for a third.
- Yugoslavia, which has received crude oil, aviation gasoline and various other crude products.
- Afghanistan, which reportedly signed an imports agreement.
- Egypt agreed in 1955 to purchase $5,750,000 worth of oil products.
- Greece.
- Argentina, which increased its Aug. 13, 1955, $75 million agreement by $30 million for oil equipment and other goods. This increase reportedly has been only a "paper" increase, and actual deliveries have been intermittent and delayed.

Exploration Planned. "The number of homes where gas is installed will increase 2.2 times, and the production of gas-benzine and of liquefied gas will rise 6.5 times. Over 250 industrial enterprises will change over to natural gas or to petroleum gas obtained as a by-product.

"With a view to increasing the reserves of natural gas, large scale prospecting work is planned in the Ukraine, the Urals, Siberia, the Stavropol-Krai, the Volga area, and other districts of USSR. Some 8.2 million feet of deep wells have to be drilled by gas prospectors during the current Five-Year Plan period. The workers of the petroleum processing industry will have to solve important problems regarding chemical processing of gas, which makes it possible to obtain methyl alcohol, formaldehyde, acetylene, chloroform, methyl chloride, and other valuable products."

Explaining the tasks of the gas pipe line administration during the current Five-Year Plan before the delegates of the twentieth meeting of the Communist Party of the Soviet Union, one delegate said:

"Special attention must be paid to the Saratov-Moscow gas pipe line. This new line is to be taken into use one year ahead of schedule—during 1956. The full utilization of the gas line and increased gas yield at Saratov will permit the 1960 volume of gas piped to Moscow to exceed the 1955 level by 4.5 times."

This delegate further explained that this line frees 400,000 rail freight cars, in addition to hundreds of thousands of trucks currently used for distributing coal in Moscow.

Currently, the Saratov gas supply is insufficient to satisfy Moscow requirements. Dashava gas fields in the Carpathian mountains of Ukrainian Soviet Socialist Republic now are participating in Moscow's supply with two lines. One line was finished during 1948, the other in 1955.

The second pipe line leads from Kiev via Tshernigov, Brijansk and Kaluga to Moscow with a total length of 510 miles. Another pipe line from the north Caucasus was planned to transport Baku gas to Moscow, but this Western report is dubious in view of the long distance between the two points.

New gas fields reported in 1955 included:

- Mirogorod field in Poltava area of the Ukraine.
- A field near Charkov in the Ukra-Neft trust.

'Russia's oil industry has become a leading branch of the national economy.'

Sixth Five-Year Plan Calls for Expansion

Oil industry minister indicates primary reason prompting redoubling of effort lies in effectiveness and low cost of crude and natural gas in comparison with coal and other fuels.

RUSSIA'S OIL industry has become "a leading branch of the national economy," M. A. Yevseyenko, minister of the USSR Oil Industry, said recently. It is also the nation's fastest growing branch of heavy industry, he disclosed, adding that gross output, which reached 513,706,200 barrels in 1955, is to be virtually doubled during the next five years, in which heavy industry as a whole is to expand 70 percent.

The Russian oil minister spoke in Moscow at the recent 20th Congress of the Soviet Union's Communist Party, which adopted the directives for the country's new national economic program in which a big role has been assigned to the oil industry.

What is behind Russia's rapid expansion of oil production was suggested by Premier Nikolai A. Bulganin, who also addressed the Congress. He said:

"Of our total fuel supply in 1955, 65 percent consisted of coal, 22.5 percent of oil and 2.5 percent of natural gas. As you see, oil and especially gas constitute a small proportion of our fuel supply. Yet, these are the cheapest and the most effective fuels. The cost of producing natural gas, for example, is only one-eighth the cost of producing coal. Furthermore, oil and gas are valuable raw materials from which many chemical products can be obtained.

"We are, therefore," the Soviet premier emphasized, "making it our policy to accelerate the expansion of the oil and gas industries to the maximum. The Draft Directives envisage increasing coal production in 1960 by 52 percent compared with 1955, the production of oil by 91 percent, and of gas nearly four-fold.

"The 1960 production of oil is to be 980 million tons, or nearly four

and a half times as much as in 1940."

Oil is cheaper to produce than coal —that is one reason behind the big expansion in USSR oil production. Another is that postwar prospecting has led to the discovery of immense new oil reserves which the Soviet state is now planning to cash in on.

Reserves Spiral. Explored oil reserves in the USSR have increased 2.5-fold since 1950, according to official sources, which report that 89 new oil and 40 new gas deposits (in addition to 164 new oil pools located in old fields) have been discovered in the past five years, more than half of them in the East, chiefly in the Ural-Volga field.

The new deposits are found not only in Devonian but also in carboniferous formations and in limestones of the Famenian and Tournaisian stages, it was indicated. New deposits also were located in Cretaceous and Jurassic formations in the North Caucasus, which is said to open up new prospects for the oldest Russian oil fields in the Baku area.

Against this background of vast new oil reserves to develop and government priority in promoting oil extraction, an impressive program has been evolved embracing all phases of the USSR oil industry: economic planning, production, drilling, exploration, refining and transportation. While many details of this program were not available, much has been disclosed by Russian officials and oil industry publications such as *Neftianoye Khoziaistvo,* organ of the Ministry of the Oil Industry USSR. The pertinent material has been collected and is presented below in an effort to give a general picture of the significant trends and broad scope of the current developments in the Russian oil industry.

Economic Planning. Since the late 1920s when the USSR launched its first Five-Year Plan of national economic development, the country's industry has been proceeding on the basis of economic planning. The new national program adopted this year is the Sixth Five-Year Plan covering the years from 1955-1960; the preceding Fifth Five-Year Plan was from 1950-1955. The Fourth Five-Year Plan carried out in the immediate postwar years (1946-1950) was primarily a program of national recovery from war devastation which affected the oil industry least of all branches of heavy industry.

In three prewar five-year plans (the Third was interrupted by the German invasion in 1941), Soviet oil production had been advanced to about 217,980,000 barrels in 1940, when about two-thirds of the national production came from around Baku on the Caspian Sea, which dates back to before 1900. Baku now accounts for about one-third of the USSR output, the bulk of which is coming from extensive new deposits discovered in the mid-Volga basin and western slopes of the Ural mountains, in the regions of Bashkiria and Tataria. This new oil-rich area has become known as Second Baku.

The eastward trend in Russian oil geography, apparent ever since the Second Baku area was discovered in the prewar years, is being continued with renewed emphasis in the Sixth Five-Year Program. Premier Bulganin stated: "Development of the very rich oil deposits in the Urals, and especially in the Volga area, is proceeding apace. In 1960, 75 percent of the country's oil is to come from these areas."

The Russian premier added significantly: "It is to our advantage to expand the oil industry in the Urals and the Volga area at high speed. Cost of production in these areas is three to four times lower than in the old oil-producing regions. However, our decision to rapidly develop oil production in the eastern areas of the country does not mean that we may relax our attention to the old sources of supply, Baku and Grozny, which provide the country with the better grades of oil."

The keynote of attention in the oil expansion program is, nevertheless, on what Minister Yevseyenko calls the "Tatar SSR, the Bashkir SSR and the Kuibyshev Oblast, also Saratov and Stalingrad Oblasts." For they are expected to yield the "major increment" in the vastly enlarged national production level and are now the base of supply for industry and farming in Soviet Asia—Kazakhstan, Siberia and the Far East—to which increasing amounts of Second Baku oil is being transported by pipe lines.

Meanwhile, prospectors are advised that "Siberia needs its own oil base. Oil and gas must be found in Siberia to meet increasing local needs and economize on transport costs."

Expansion of Production. The annual increment rate in Soviet oil production for the next five years is scheduled to double the rate of the past five years; which was, in turn, about double the rate during the five years of the immediate postwar period from 1945 to 1950. Here are the rates at which Russian oil production has been expanding according to official sources.

Five-Year Plan Period	Annual Increment Rate (in millions of barrels)
Fourth	23,251,200
Fifth	47,229,000
Sixth	87,192,000 to 101,724,000

In daily production this means that whereas 1955 output averaged 1,525,860 barrels, 1960 output is to average 2,906,400 barrels daily.

Russian economic planners point out that during the past ten years the annual increment of oil output in the U.S.S.R. has averaged 14 percent; in the U. S. it has been 4 percent. In absolute growth during the two years preceding 1955, the U.S.S.R. increment was 130,788,000 barrels, the U. S. increment was 101,724,000 barrels, the same official Russian sources say, stressing that growth rates in the U.S.S.R. are higher than in U. S.

Production growth in Russia is based both on developing new deposits and improving production methods. Increasing attention is being paid to methods of secondary recovery. That this program is meeting with a measure of success is indicated by figures cited in the Russian oil trade journal, *Neftianoe Khoziaistvo,* which gave the following data on the amount of water and gas being pumped into the wells daily, and the rise in the average yield per well.

Under the new system of producing fields, the number of operating wells has been reduced because of the trend toward increasing well spacing. Spacing has been increased from 5 to

Secondary Recovery Program and Results

Year	Water Pumped Into Wells (Barrels)	Air and Gas Pumped Into Wells (Cubic Feet)	Average Percentage Yield Per Well
1950	177,370	31,112,030	100
1955	1,657,350	84,754,680	125

7.5 acres under the old system to the current 50 to 75 acres.

The new Sixth Five-Year Plan directives set the 1960 goal for the number of fields produced by artificial means at 82 percent of the total, compared ot 58 percent in 1955. In citing this objective, the Russian trade journal noted that "because of the wide application of the methods of artificial action, the induction of wells into operation during the whole Five-Year Plan period is retained at almost the actual level of induction during 1955. In order that this object be achieved, it is first of all required that prior exploration and mapping of deposit boundaries be seriously reorganized, and prospective wells be thoroughly investigated so that an estimate be obtained in the shortest time of the area's oil wealth and the most applicable means of production action."

With wider use of pressure maintenance practices, the journal demands that new instruments developed on the basis of nuclear physics be more generally employed for determining water-oil contacts in the wells.

Drilling Rate Rises. "In order that the oil industry might develop at accelerated rates," said Minister Yevseyenko, "it is necessary in the Sixth Five-Year Plan period to advance the speed of drilling headway up to 1650 meters (5412 feet) per machine month in development drilling and 600 meters (1968 feet) per machine month in exploratory drilling. In particular, in 1956 the speed of development drilling must be increased to 1100 meters (3608 feet) against 925 meters (3034 feet) in 1955, i.e., by 18.9 percent."

In setting these goals for drilling operations, the Russian minister also said "it is planned to cut the cost of 1 meter (3.2 feet) of headway in 1960 by 30 percent as compared with costs in 1955."

This, then, is the five-year drilling program: to increase speed of development drilling by not less than 85 percent, of exploratory drilling by 95 percent and to cut drilling cost by 30 percent.

As for total volume of drilling contemplated, *Neftianoe Khoziaistvo* offers the significant suggestion that "it must be emphasized that drilling at the rate of 5 million meters (16.4 million feet) per year cannot be acknowledged sufficient to provide for the still higher rates of development in the oil industry."

The increase in the drilling rate, which for the industry as a whole more than doubled since 1950 (the highest rates being recorded in exceptionally hard rocks in the east), is associated with a rising proportion of rotary turbine drilling. In the period from 1951-1955, rotary turbine drilling accounted for 55 percent of all drilling; in the period 1946-1950, it accounted for 16.8 percent.

In the Ural-Volga fields, where the fastest drilling rates were achieved, rotary turbine drilling accounted for 96.6 percent of the total. During 11 months of 1955 in Tataria oil fields the average drilling rate was 13.71 meters (44.96 feet) per hour, while in Azerbaidjan (Baku oil field) it was 5.42 meters (17.77 feet) per hour.

A typical feature of current drilling operations has been "concentration in the most productive and promising areas of the country's eastern regions, which permitted stepping up the increment rate of oil extraction (production) even with a certain reduction in the increment rate of volume of drilling headway," according to an official report.

The increase in the drilling rate is attributed to technical re-equipment with rotary drilling units and mastery of new drilling methods by advanced brigades (crews).

Great strides have been made in what is termed a "forced regime" of drilling, with 96 units operating in 1950 and 600 such units in 1955. Advance brigades which in Russian terms "were able to combine mastery of the new techniques with measures to eliminate unproductive time losses" achieved notable records. The Russian trade journal gives these drilling records as held at the end of 1955:

- 2473.3 meters (8112.4 feet) per machine month at exploratory well by the brigade of Foreman Gafarov.
- 3326 meters (10,909 feet) per machine month by brigade of Foreman Beloglazov.
- 18,000 meters (59,040 feet) and 16,000 meters (52,480 feet) during 1955 by brigades of the noted Foremen Gimazov and Gayfulin, respectively.

These marks in drilling are said to be two to three times higher than those of the average brigade operating in the U.S.S.R., and there is dissatisfaction with labor productivity in drilling.

The new program calls for a rise of 14.2 percent above 1955 in labor productivity this year, with corresponding rises during subsequent years in accordance with advances in technology. Drilling teams are being criticized for wasting time on breakdowns and auxiliary work: during 11 months of 1955 more than half the total drilling operational time was spent on stoppages and breakdowns (28.6 percent) and on auxiliary work (26.1 percent). Cutting out much of this waste time is considered an important step toward raising labor productivity.

Various measures to improve drilling technology are being promoted, including:

- Transition to drilling smaller diameter wells.
- Re-equipping rotary turbine drilling with gear and tools that will provide for universal use of forced drilling regimes.
- Improvement of drill bit quality to lengthen operational life.
- Complete reorganization of drilling muds by shifting all drilling units to powdery clays and reagents.
- Experimental work is being promoted on new systems of pipeless drilling with electrodrills and hydrodrills, but according to Minister Yevseyenko the research is proceeding "extremely slowly" and the time spent on design and testing "must be drastically reduced."

Exploratory drilling is being advanced with new "go-anywhere" equipment. The program calls for developing within the next two years portable and semi-portable outfits for drilling small diameter wells to depths of up to 8000-10,000 feet, light seismic stations together with accessory drills, and jeep-mounted repair shops to go with them. This new equipment is being designed for use in rough country without roads since Soviet exploration efforts extend over Siberia.

Refining Objectives. "In the years of the new Five-Year Plan, it is necessary to provide for an increment of 60 million tons (436 million barrels) in oil refining capacity," said Minister Yevseyenko, adding "This is the equivalent of putting into operation every year two new plants of 6-million-ton (43.5 million barrel) refining capacity each. If it be considered that

construction of one plant takes five to six years, then it becomes obvious that old methods of designing and constructing oil refineries are quite inadequate for achieving the goals set in the new Five-Year Plan and must accordingly be revised."

Pipe Line Expansion. "The big targets set for the production of oil will necessitate a big expansion of pipe line transportation of oil and oil products," Premier Bulganin has said. "In the Sixth Five-Year period, it is planned to lay more than 14,500 kilometers (9000 miles) of arterial pipe lines. The share of pipe lines in the total transportation of oil will increase more than 2.5-fold."

Arterial pipe lines in the U.S.S.R. in 1955 were carrying about 950,000 barrels of oil and oil products a day, according to official reports. Pipe line transportation of oil and oil products in 1960 is scheduled to reflect a six-fold expansion from 1955.

N. K. Baybakov, chairman of the State Planning Commission U.S.S.R., the former oil minister, gave an imaginative appraisal linking the refining and pipe line program:

"In the current Five-Year period oil refineries with capacity greatly surpassing that of plants in Baku, will be built in Siberia. All these plants will be connected by pipe line with the oil fields of Tataria and Bashkiria. In addition to the pipe line in operation between Tuimazy and Omsk, a powerful 3700-kilometer (2310-mile) pipe line will be constructed from Tuimazy to Irkutsk, and in the following Five-Year period it will be extended to the Amur Oblast, and then to Khabarovsk territory. Moreover, pipe lines will be built for transfer of ready products from the plants to local consumers. In order to picture the capacity of the indicated pipe lines, suffice it to say that if the oil and oil products being piped had to be transported in tank cars on the railroad, then it would be necessary for this purpose to build a new trans-Siberian track."

The oil pipe lines in the Soviet east are projected ultimately to emerge at Khabarovsk on the Pacific coast of Siberia; those being laid in European Russia are projected to emerge at the port of Odessa, on the Black Sea. This was made clear by Minister Yevseyenko, who said:

"At the present time petroleum is supplied by pipe line to Kuibyshev, Ufim, Saratov, Omsk and other oil refining plants. In the Sixth Five-Year period the construction of pipe lines will be continued in the direction of the eastern regions of the country. Moreover, petroleum from the field will come by pipe line to supply refineries in Moscow, Gorky, Ryazan, Yaroslavl, two refineries to be built in Byelorussia, and one plant in the Ukraine, with outlet of the pipe line in the port of Odessa."

The new projected pipe lines are big-inch arterial lines, with special attention to automation of pumping stations, according to the official program.

Soviet aid erased need for camouflaging Communist government's inability to boost yield

Hungary's 1955 Crude Output Best Yet

New discovery in Lovaszi field is indicated. Nagylengyel emerges as the largest producing region in the nation, accounting for 60 percent of total 1955 production of 30,050 barrels a day.

By VERITAS*

THE YEAR 1953 was the first for which the Central Statistical Office of the Hungarian Government published official figures on crude production. Until then, annual production was camouflaged by percentage increases keyed to prior years, which made it difficult to get a true picture of the production.

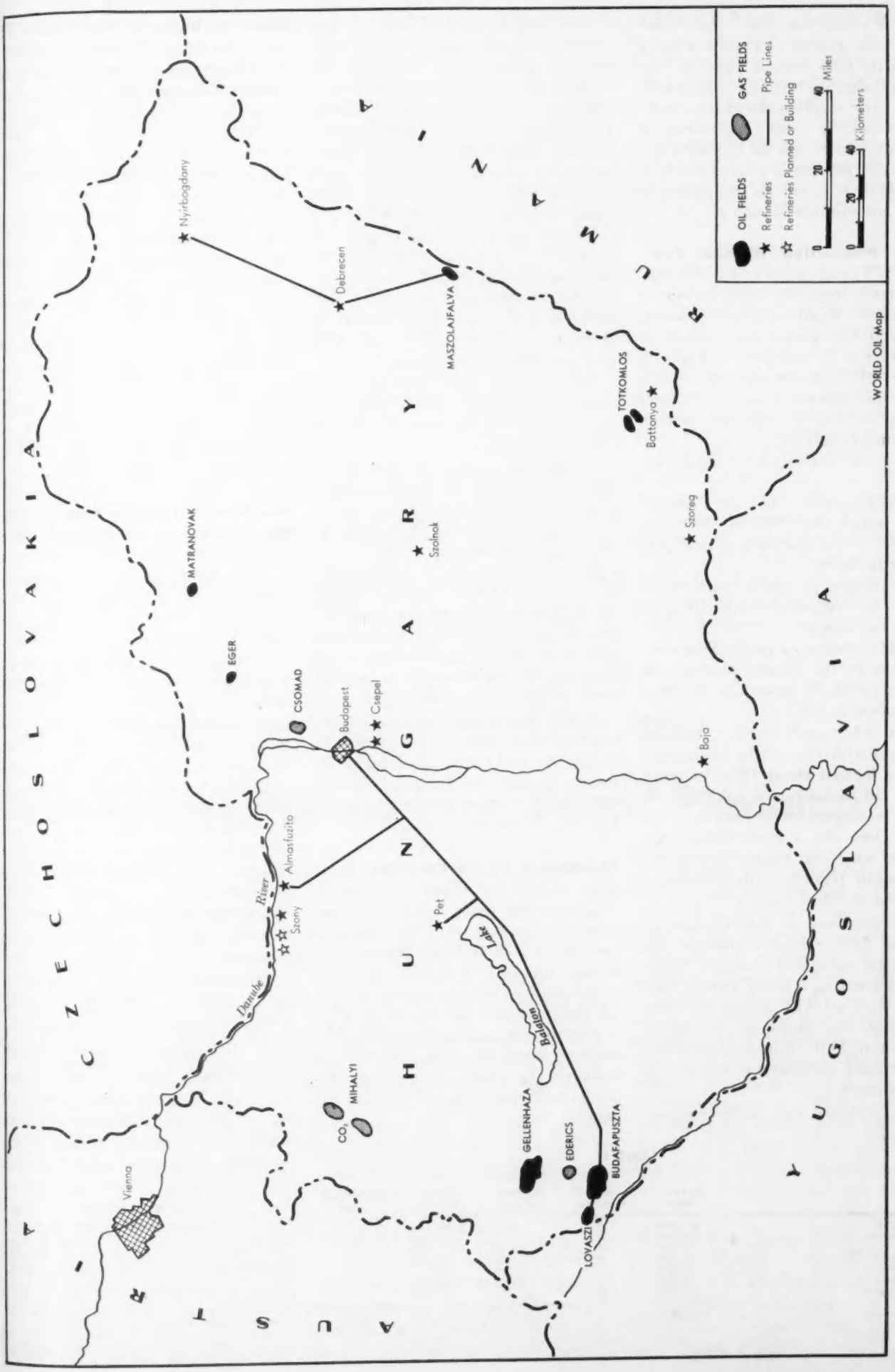
In retrospect, the strategy behind this becomes clear. Up to 1953, i. e., four years after seizing the private industry, the Communist regime had not been able to increase production substantially. So, propaganda-wise, the percentage increases particularly when related to 1938 (288,000 barrels)—the first full year of production in Hungary—sounded impressive and were calculated to mislead the outside world.

Naturally, once successful through Soviet aid, there was no longer any reason for hiding the results. Of course, so long as the Central Statistical Office is under secret police supervision, figure-juggling will always be possible, though in this case there is no denying the success of four years of Communist effort. One should not forget, however, that private industry could have done at least as well, if given a chance.

Barrel Figures Require Qualification. In converting metric tons to barrels, arbitrary conversion factors or those of the Bureau of Mines are used in the U. S. As a result, there usually is a marked discrepancy between any two sets of figures relating to Iron Curtain countries. That, of course, is because the specific gravity of the crudes, which determines the conversion factor, is not known. The Bureau of Mines indices, based on pre-war crudes are no longer valid since current crudes differ greatly in their composition from those produced before the war.

A case in point is Hungary, where 1955 production is officially claimed as 1.6 million metric tons. Converting this tonnage at the prewar average rate of 7.6 barrels per ton, the result is 12.2 million barrels. On the other

* Translated from Latin means "truth." The author, who prefers to remain anonymous, has been a student of oil industry developments behind the Iron Curtain and speaks, therefore, with authority.



HUNGARY . . . A new field reportedly was discovered in April, 1956, at Eger, in the northern section of the country. Eight producing wells have been completed; however, geological conformation does not favor the existence of large oil deposits.

hand, if conversion is at a rate based on specific gravity of current crudes, averaging 6.86 barrels per ton, the 1955 production becomes only 11 million barrels, a difference of more than 10 percent. It would, therefore, be prudent, unless specific gravities are known, to use metric tons as much as possible or to qualify barrel figures to avoid any misunderstanding.

1955 Production Highest Ever. The 1955 crude production (1.6 million metric tons), by fields, converted into barrels based on specific gravity, shown in API gravity for the sake of convenience, is indicated in Table 1.

The 1955 production of 30,050 barrels per day compares with 22,910 barrels per day in 1954, an increase of about 31 percent.

Table 1 reveals two significant facts:

1. API gravity of the Lovaszi crude, which was 39°, in 1948, due probably to the discovery of new producing horizons.

An analysis of the Lovaszi crude today, as compared with 1948, is shown in Table 2.

2. The emergence of the Nagylengyel field as the largest producer in Hungary with 60 percent of the total production in 1955.

This field, until recently believed identical with the nearby Gellenhaza field, is located about 12 miles north of the old Budafapuszta field, but not much was heard of it until late last year. Then the various Communist regimes somewhat relaxed restrictions and began publishing data formerly classified as "state secrets."

The discovery of the Nagylengyel field in 1951 radically changed the producing picture in Hungary. Nagylengyel crude is a heavy asphalt base crude with an API gravity of about 15 degrees and an asphalt content of 60 percent. Difficulties of production and refining considerably delayed its development.

A new pump had to be designed to overcome the lack of subterranean water and gas pressure, and special refining arrangements had to be worked out. An asphalt plant was constructed at Zalaegerszeg, about 5 to 6 miles northeast of Nagylengyel, but this plant does not appear large enough to take care of the entire production, which amounted to more than 6 million barrels in 1955.

To use this crude locally as much as possible, two plants were built for blending the heavy fuel (pacura) of the Nagylengyel field with peat that abounds in the area. This mixture is being used as locomotive fuel, and excellent results are claimed.

By the end of 1955 about 100 locomotives had been converted for the use of this new fuel and the process was to continue.

These two plants are located at Zalaegerszeg and at Nagykapornak, respectively, the latter being about 10 miles southeast of Zalaegerszeg. The Nagykapornak plant capacity was reported as 6000 barrels daily, to be increased to 12,000 barrels a day in 1956. The government has been exporting asphalt to the free markets, and it is claimed that because of its high quality, the product can hold its own on the world markets.

It also is reported that some of the crude is being sent to the refinery at Szony, on the Danube river, for processing. It is doubtful, however, whether this refinery is of much use because of its obsolescence.

Increase in Crude Reserves. As a result of the discoveries made during the past five years, total crude reserves at the end of 1955 were estimated at 233 million barrels (34 million tons at 6.86 barrels), as compared with 27 million barrels in 1948 at the time of the take-over. This represents approximately a nine-fold increase since that time and will be sufficient for about 21 years at the 1955 production rate of 11 million barrels.

Efforts to Increase Production. To solve the country's energy problem, the Hungarian government has been making desperate efforts to increase oil production. The reason is that coal resources are limited and, since most of the country is flat, hardly any possibilities exist for the generation of hydro-electricity.

Exploration activities, therefore, have been intense during the past four years and have covered practically the whole country (See areas marked with dotted black circles on map).

As a result of these widespread exploration activities, the conclusion was reached that the most promising area still is Transdanubia, the former American concession, and it is, therefore, there that future drilling activities probably will be concentrated.

Ambitious Five-Year Plan (1956-60). Hungary being poor in natural resources, the current Five-Year plan lays emphasis on the continued development of the oil industry, particularly oil processing and the establishment of a petro-chemical industry.

Drilling is to be increased to almost 4 million feet as against 2 million feet drilled during 1950-54. This compares with about 1.8 million feet drilled in Hungary during the period from 1935 to September, 1948. Depths of 10,000-15,000 feet are to be attained. So this program may be fulfilled, the Soviet Union was scheduled to supply a number of turbo-drills to Hungary for the first time. It is planned to drill to a depth of 10,000 feet at the old Budafapuszta field in the hope of finding new producing horizons.

Production in 1956 is expected to be increased to 12.2 million barrels, a modest increase of slightly more than 10 percent as compared with 1955. Secondary recovery methods are to be applied and deeper horizons tapped in order to boost production, which is to reach 13.7 million barrels by 1960. This is only a 25 percent

TABLE 1

FIELD	Metric Tons	API Gravity	Barrels Per Ton	Total Barrels	Percent of Total
Nagylengyel	960,000	15	6.53	6,268,800	60.0
Budafapuszta	224,000	39	7.59	1,700,200	14.0
Lovaszi	224,000	30	7.19	1,610,600	14.0
Gellenhaza	64,000	38	7.55	483,200	4.0
Maszolajfalva	57,600	31	7.23	416,400	3.6
Totkomlos	38,400	41	7.68	249,900	2.4
Matranovak	32,000	38	7.55	241,600	2.0
Total	1,600,000	..	Avge. 6.86	10,970,700	100.0
Daily	4,383	..	.....	30,050	....

TABLE 2

YIELD	1955	1948
Light gasoline	7.7	23.0
Heavy gasoline	6.2	27.0
Gasoil	12.2	12.0
Kerosene	50.8	30.0
Fuel oil	22.9	3.0
Loss and impurities	0.2	5.0
Total	100.0	100.0

increase, or 5 percent per annum, as compared with 1955.

New Field. Discovery of a new field last April was reported at Eger in northern Hungary. Eight producing wells already have been drilled. However, this field is not expected to be very prolific as geological conformation does not favor large oil deposits, this being probably a faulted area with small lenses containing oil. Pre-war drilling in this general area discovered a small field at Bukkszek since abandoned.

Radio-activity will be introduced in the oil industry during the current Five-Year plan. Radioactive isotopes will be sent from the Soviet Union, which will find application in secondary recovery methods and in locating blocked go-devils in the pipe line. Also the gamma and neutron logging methods will receive practical application in drilling. This will aid in getting a clear picture of the formations in depths and their composition.

Shocking Conditions in Oil Industry. One would have thought that the high production attained in 1955 was at least to a small degree due to greater efficiency, better coordination and sufficiency of oilfield equipment. This is, however, not so. Nepszava, a Budapest daily, of March 11, 1956, writes extensively about the deplorable conditions in the oil industry, the gist of which follows:

The drilling programs has not been carried out during the first few months of this year. Also, for about one and a half years, i.e., from January, 1954, to the middle of July, 1955, a large part of the drilling equipment lay idle as no spare parts were available. As a result, the idle equipment was stripped for spare parts. It is claimed that this situation resulted from the "false industrial development of the years 1953/54."

In the fields one finds mostly old equipment. Engines instead of the normal 8000 hours, have been kept running for 28,000 hours, and there can be no question of repairs because of shortage of spare parts. Transportation of the material required in the fields likewise is delayed for lack of trucks.

The moving of drilling equipment weighing 200 tons to another location requires a month because only about 25 percent of the transportation equipment is in usable condition at any one time. For many months no trucks have been delivered to the oil industry, but the newspaper bitterly remarks, trucks had been delivered "to cleaning establishments, the feather industry and even to the dog-catcher in Nagykanizsa."

Drilling equipment, including drill pipes, likewise in short supply, is being obtained to the extent of 25 percent from abroad and, therefore, delivery of this equipment depends largely on the foreign exchange situation. Through larger exports and the postponement of many necessary purchases, the oil industry endeavored to insure the procurement of some badly needed oilfield equipment from abroad, but it has not succeeded as the resulting foreign exchange was diverted for other purposes.

It may, therefore, be said that unless this situation is remedied soon, it is doubtful whether the ambitious goals of the current Five-Year Plan can be carried out.

Secrecy tightens about petroleum industry as never before

USSR Draws Poland Into 'Zonal' Planning

By DR. G. G. ROSU

JUDGING BY the absence of oil production targets set for the current Five-Year Plan, one may infer that Poland has given up her ambition to attain self-sufficiency in regard to liquid fuels. The Planning Board announced that drilling operations only will be increased by 60 percent as compared with the previous plan and that, by 1960, half of the drilled footage will be performed by turbodrills.

Of course, it remains a matter of speculation as to what success Poland is envisaging from turbodrilling as long as the proper yardstick, i.e., the production targets, remain the missing link.

More than ever before, the Polish oil industry now is enwrapped in secrecy. And there are some disturbing reasons which explain this evolution. By the terms of an agreement, signed in December, 1950, Russia undertook to supply Poland with "modern" drilling equipment with the help of which the latter could drill holes of up to 9000 feet.

If, however, the production pattern is taken as a yardstick, the impelling conclusion is that Russia was, indeed, a laggard in fulfilling her obligation. The crude output amounted, in 1955, to 2,042,000 barrels which is only two-thirds of the target set by the Six-Year Plan. Obviously, the lack of equipment limited the drilling activity to an average of 200,000 feet per year, the major part of which was carried out in known fields, and for production purposes.

The production pattern is, in turn, commensurate with the industrial reserves. During the past 11 years, Poland's biggest problem has been to discover new reserves. In the boundary changes following the last war, Poland was left the less promising structure of the Carpathian Foreland.

Its Border Zone, on which are located the rich oil fields of Wankowa, Boryslaw, Drogobycz, Rypne, Bitkow-Pasiechna, as well as the profuse Daszawa gas fields was incorporated into Russia. Poland retained the Central Zone and the Magura Plateau on which is located a chain of comparatively poor fields, extending from Gorlice eastward over Jaslo, Krosno, Sanok and, since 1951, to Ustrzki Dolny.

If it is borne in mind that Ustrzki Dolny is regarded as the most promising structure of all, prospects of the other fields may be assessed. For the last 90 years, they have been yielding a very modest production.

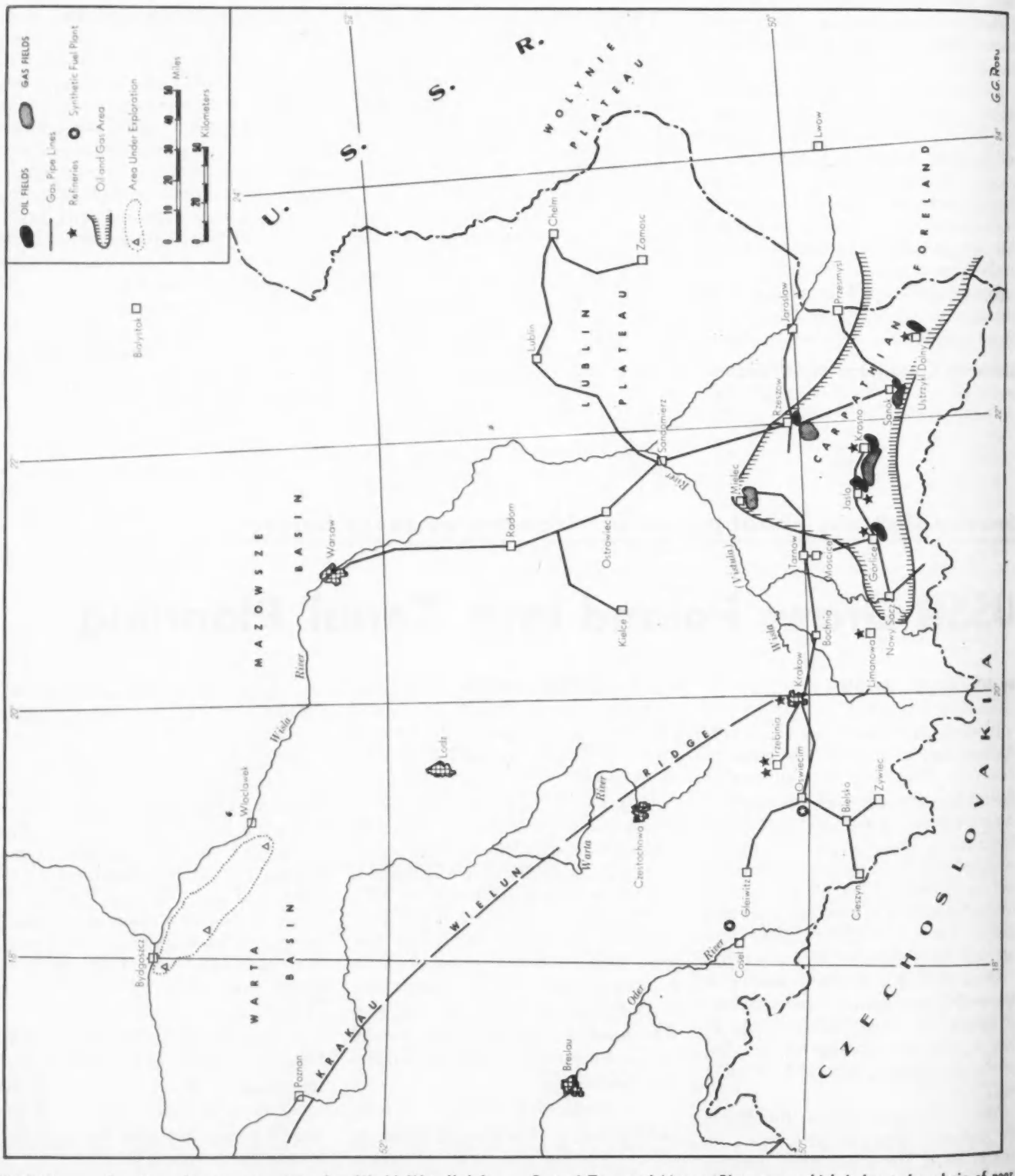
The search for a "second Boryslaw fold" in the Carpathian flysch of the

Central Zone was resumed after World War II but then silently shelved.

The very narrow folds, and the very steeply-inclined beds preclude any substantial oil and gas accumulations. However, it would be a hurried conclusion to write off completely the Central Zone and the Magura Plateau as long as their deeper horizons (first of all, their Lower Cretaceous beds) are yet to be explored.

Another hopeful structure seemed to be the Permian Basin of the South Pomeranian Plateau, which was surveyed before 1939. At that time several salt domes and plugs were located which may be accompanied, as in Germany, by oil accumulations. The exploration drilling carried out, after 1947, south and west of Bydgoszcz apparently was unsuccessful.

This lack of successes reflected into the hard fact that Poland embarked upon its new Five-Year Plan with known reserves representing, at best,



POLAND . . . Boundary changes occurring after World War II left Poland the less promising structure of the Carpathian Foreland. While losing the rich oil fields of the Border Zone, the nation retained the Central Zone and Magura Plateau on which is located a chain of poor fields, extending from Gorlice eastward over Jaslo, Krosno, Sanok, and, since 1951, to Ustrzykl Dolny.

seven years of supply at the present production rate.

Zonal Planning. The Soviet Orbit's new "zonal planning," inaugurated in 1956, apparently, relegated the Polish oil industry to a secondary position. The core of this new planning lies in the coordination by Russia of all the quinquennial plans of the East European countries in such a manner as to suit the Soviet long-range planning.

According to official explanation volunteered by Moscow, these countries will, henceforward, develop only those industries and types of products for which they have the most favorable geographical and national conditions. After a decade of national planning aiming at self-sufficiency, they were ordered to "specialize" in those production sectors indicated by the Soviet-controlled Mutual Economic Assistance Council.

The avowed goal of the new "zonal planning" is to lower production costs, increase labor productivity and, thereby, accelerate the accumulation process.

The Mutual Council evidently decided that the Polish oil industry will not help to increase the "accumulations." Hence, Poland had to abandon its oil plans. It will remain, at least for the next 4 or 5 years, the biggest oil consumer of the Soviet bloc.

This explains why it refrained from announcing production targets for the current planning period. Whatever surveying and drilling activities are to be pursued will have to be covered from means which will not interfere with the Soviet zonal planning.

Rumania has been slated to nurse the Polish oil industry during the current period. According to terms of an agreement for scientific and technical assistance of 1954, the former will supply Poland with drilling equipment, spare parts and blueprints. The two countries also will exchange information about oil experiences and, in addition, Polish technicians will improve their training in Rumanian oil fields.

Following a great boost in road and river transportation, and the doubling of the number of tractors, Poland's oil consumption rose steeply to approximately 15 million barrels (in which quantity bunker oil for its three Baltic ports is included). Poland's own resources may cover a mere fifth of the total demand. Its resources amounted, last year to about 3.1 million barrels:

- Oil products from own crude oil —1.8 million barrels.
- "Syntina," or the synthetic fuel produced by the chemical combines at Dwory and Cosel—900,000 barrels.
- LPG and other substitute liquid fuels—400,000 barrels.

The balance of almost 12 million barrels of products is covered by Russia from the reparation oil she receives freely from Rumania and Austria and, to a lesser extent, by Rumania as commercial export.

Refining. The Polish oil plan is, however, less secretive in one respect, namely, that the processing capacity will be increased quickly so as to keep pace with the rising domestic demand.

The throughput capacity of six small plants amounts to 7000 barrels a day. To this is added the 5000 barrel-daily capacity of the new Trzebinia plant. The government intends now to build a new refinery (the location of which has not yet been disclosed) with an operative capacity of 9000 barrels a day in 1960 which, two years later, will be expanded to total 17,000 barrels daily.

Therefore, in 1962, the total throughput capacity may amount to 29,000 barrels a day which, however, represents only two-thirds of the present consumption level.

The government has further announced that, after 1962, an additional refinery with a 40,000 barrel-a-day capacity will be constructed. When completed, this plant may become the most modern chemical unit in Eastern Europe able to process a whole chain of products. It will compare favorably with the new units built now by the Soviets in southeastern Siberia. For the time being, nothing is known about its location or the date of its completion.

When these two blueprinted refineries go on stream, the processing capacity will rise to approximately 64,000 barrels a day (presuming, of course, that the operation of the six small units will be discontinued)—which will exceed Poland's consumption requirements even for 1965.

Natural Gas. For lack of crude oil, Poland turned to the gas industry for supplying the domestic market. In 1938, when the rich East Galician gas fields belonged to Poland, the gas production reached 20.6 billion cubic feet, of which half was consumed on the spot as boiler fuel.

The main gas field within the post-war frontiers was Potok-Roztoki, located south of Jaslo. This field shows signs of depletion owing to the overproduction to which it was subjected since the last war. The only post-war success scored by the Polish industry was the discovery, in 1947, of a large gas field at Debowiecz-Simoradz, near Cieszyn, on the Czech-Polish border. Soon afterwards, a second gas field was tapped at Mielec, the production of which is far more modest.

After the war, the gas industry more than doubled its production, but this is still below the pre-war level:

Natural Gas Production in Poland
(In Billion Cubic Feet)

1938	20.6
1946	8.5
1950	9.1
1955	18.5

Some gas also is being recovered from the Silesian coal seams by vertical drilling. The gas then is pumped by a compressor plant into the natural gas network.

Natural Gas Consumption in Poland

	1938	1955
Oil industry (boiler houses)	49.3%	6.2%
Chemical industry	21.8	12.2
Other industries	20.9	56.1
Household and town lighting	8.0	10.5
Other purposes and losses	n.a.	15.0

A small quantity of natural gas is compressed in tank stations and used as fuel for motor vehicles.

The post-war expansion of the cokery plants resulted in increasing surpluses of coke-oven gas, which is being used as fuel on a large scale. Since 1948, extensive work was carried out for building new compressor stations, purifying plants, storage reservoirs, and mains for the supply of coke-oven gas to consumers. In certain regions, the transported coke-oven gas proved to be half as cheap as the locally-manufactured gas. Hence, many municipal gasworks became unprofitable and discontinued operation.

Pipe Lines. During the post-war years, the natural gas network was

expanded by a third and, at present, totals approximately 950 miles of mains. Natural gas is supplied from the Carpathian foothills to Warsaw over Sandomierz and Radom as well as to Lublin and Zamosc. In the west, the network was extended to the Trzebinia refining center, to the chemical combine at Dwory, and farther on to Gleiwitz.

The old coke-oven gas network, connecting Gleiwitz, Oppeln, Breslau, and Goerlitz, has been restored to normal function. A second gas pipe line, 200 miles long, now under construction, will transport coke-oven gas to Warsaw. Along its way northwards, it will supply also Tomaszow, Piotrkow, Lodz, and Zyrardow.

Several cities, including Warsaw, soon will have a combined gas-supply system: natural, coke-oven and manufactured gas produced locally. Before feeding it into the city's distribution network, the natural gas will be blended with water gas and with reformed gas.

The current plan provided for further search for natural gas fields, for fuller use of coke-oven gas and for further expansion of the gas network.

Outlook Bleak. However impressive these plans and efforts may appear they will hardly alter the Polish fuel and energy picture which is characterized by chronic shortages and perpetual restrictions. The generation and distribution of energy has not yet caught up with the burden put on Poland's shoulders by the incorporation of the highly industrialized German lands, and is badly lagging behind the present industrialization rhythm.

In addition, the fuel bill becomes costlier, and this is reflected in the cost prices. Only massive investments in hydro- and thermo-electric power plants as well as in extensive oil exploration work may alleviate Poland's present energy drama.

The sparse details known about her current plans and the scarcity of investment funds leave, however, no doubt that Poland is not prepared to meet this critical situation. It will, instead, continue to cut deeper into private consumption, to patch up shortages from one month to the other, and to emulate the workers through "socialist competitions" to cut the consumption of fuel and power in factories.

Rumania Petroleum Industry Faces Burdensome Future

With crude production claim of 215,300 barrels daily, thanks partly to secondary recovery practices, nation's oil still under the heavy hand of Russian influence.

EUROPE'S BIGGEST crude producer, Rumania, has been firmly under Soviet domination since the Russian army "liberated" the country on Aug. 23, 1944. Therefore, the nation's 17 million inhabitants do not enjoy full sovereignty and freedom.

Politically bound through the Rumanian Communist party, economically tied through membership in the Council of Mutual Economic Assistance, and militarily subjugated by the May, 1955, Warsaw Pact, Rumania is the No. 1 victim of Soviet dictatorship. And so is its oil industry.

Siding with the Allies during World War I and with Germany during World War II, Rumania emerged from both wars badly damaged. Private foreign investment in its oil industry pushed Rumania into a state of relative wealth after World War I. But after World War II, Russia moved in and absorbed all foreign investments as its share in the 1945-founded joint Rumanian-Soviet Petrol Monopoly.

While Rumania benefited through revenues from private capital oil companies from abroad from 1918 to 1939, it has not received a cent from its crude production since 1945.

Since Oct. 17, 1954, when Russia sold its 50 percent share in SovRum-Petrol, the oil monopoly, to the Rumanian state and withdrew from the oil industry, Rumania has not been able to dispose freely of its oil and has not been able to charge an equitable amount for its oil. Russia still is dominating the industry—and without investing any money or assuming any risks.

Production. Crude output last year is claimed to have reached 78,587,950 barrels, or 215,309 barrels a day. This figure was revealed by Ion Dumitru, Rumanian minister of the Oil Industry. In a statement made Dec. 31, 1955, Dumitru said:

"The Five-Year Plan was fulfilled four months in advance of schedule and output was more than 14,870,000 barrels above the peak output under the 'bourgeois landowner regime.' The increase planned for the next Five-Year Plan (1956-1960) amounts to 28 percent (for 1960 as compared with 1955). Thus, a yield of 100,372,500 barrels is to be reached by the end of 1960. Exploitative drilling will grow by 55 to 60 percent as compared with the First Rumanian Five-Year Plan, with exploratory drilling to be extended to new areas as well.

"Drilling speeds will be increased at least 25 percent by application of advanced methods. Gas production will increase 2.6 times, reaching 353 billion cubic feet by 1960."

Crude production in Rumania is as much a secret as it is in all other East Bloc countries, despite the release of occasional actual figures instead of percentages. Repeatedly, Western

sources have pointed out that actual production during the first post-war years was much smaller than the reported figures. However, the actual output during the past three years is said to have been much higher than the announced level.

In the absence of the possibility of checking actual production, the figures in Table 1, compiled from various sources, may be considered in evaluating Rumania's oil position.

TABLE 1
Rumanian Crude Oil Production
(In Barrels)

YEAR	A*	B**	Plan vs. Fulfillment	Increase in Percent Over Previous Year
1938	51,078,450	.....	.....	.....
1945	34,543,010	.....	.....	.....
1946	31,174,955	.....	.....	.....
1947	28,327,350	28,327,350	.....	.....
1948	32,044,850	.....	.....	.....
1949	35,093,200	.....	.....	9.4
1950	37,524,445	39,405,500	.....	13.5
1951	48,959,475	59,182,600	.....	22.5
1952	63,108,280	62,454,000	1.2% surplus	28.9
1953	67,338,795	70,632,500	0.9% short	13.0
1954	74,350,000	75,837,000	0.4% short	7.5
1955	78,587,950[1]	.....	2.0% short	8.0
1955/P	81,785,000[2]	.....	.....	.....
1960	100,372,500[3]	.....	.....	28.0***

/P means Planned.
* Figures from West German Institute of Economic Research—1938 to 1954.
** Figures evaluated from Western reports and Eastern claims.
*** Planned increase at end of Second Five-Year Plan.
[1] Revised statement by Minister Dumitru.
[2] Revised plan announced in 1953 by Rumania.
[3] Planned objective at end of Second Rumanian Five-Year Plan.

Moscow's Pravda news agency reported in 1955 that Rumanian crude production "had reached 78,067,500 barrels up to the middle of September, 1955, thus permitting the expectation of an annual yield of 107,807,500 barrels."

Production in Rumania is handled by "trusts," or companies, of which there are seven. They are:

• Trusts 1, 2 and 3. This area, the Prahova valley, is described as the "greatest of all known deposits." Pre-war fields in this region are Moreni, Tintea and Floresti. They are declining but new fields have been opened up during the past few years. It is doubtful whether any of the three companies lead the list of 1955 producers.

• Trust 4 is headquarters in Moldavia and supervises Moinesti, Zemes and Lucacesti fields. The area is the most productive of the country's current producing regions. Moinesti was declared depleted during pre-war years, but deeper drilling to about 11,500 feet has discovered additional pay zones. The 1954 yield reportedly equals the 1949 production rate plus 480 percent. Compared with 1951, production is said to have increased by 59.7 percent, and a 11 percent rise was demanded for 1956.

The first Soviet turbodrills were used in this area. Drilling rate reportedly increased here by 248 percent from 1950 to 1955. Drilling was scheduled to rise 28 percent during the next five years.

• Trust 5 operates in Podul Mihai Bravul, Viforita, Aninoasa, Doicesti, and Dragomirest. These fields are located along the Targoviste-Petrosita. Although it was abandoned in 1947, Targoviste later was reactivated and has participated in the crude output since 1952.

• Trust 6 of Targoviste controls a field now in full development in Dambovita. Dambovita production in 1951 exceeded that of the Sutea field. The best developed areas under this company's control are Cobia, Garleni and Padureni. Valea Caselor, which at one time belonged to Targoviste, was set up as a special operating area in 1951. Expansion activity was being directed toward Pitesti and Geasti.

• Trust 7 in Valea Caselor (Caselor Valley) reported 800 wells in operation during 1954. With "considerable development work done" in the area, a further increase was expected from this area.

Another area expected to increase in importance is Oltenia, which went into production during 1954. Wells have been drilled at Albeni, Belteni, Pesteana de Jiu, and Targa Jiu. Intense development also was reported in Sacel. The Gorj producing area is in the center of Oltenia; its size can be estimated since the Rumanian government decided to build a refinery near the field.

Secondary Recovery. Secondary recovery is playing an important role in Rumania's crude production. Boldesti, for example, increased its output three or four times in 1953 over the 1950 production because of water and gas injection programs.

According to Rumania's Deputy Oil Minister Iancu Horatiu, "more than two-thirds of Rumania's crude output stems either from new wells or from deep wells in old fields."

Secondary recovery efforts by Moldavia's Production department No. 4 resulted in the production of an additional 4,646,875 barrels. These conservation practices are to be extended, and an 11 percent increase was expected to be reached during 1956 over Moldavia's 1955 record.

Deputy Minister Horatiu said early in 1954 that 20 secondary recovery stations had been established, with crude output increase resulting through these stations amounting to 6 percent annually.

At Baicoi field, water injection resulted in a 150 percent increase in production at Well 1, while Wells 2, 2-bis, and 3 produced 20 percent more oil after treatment.

Well 7 at Bucsani of Gura Ocnitzi, inactive from 1937 to 1952, has been operating since the waterflooding, and its yield equals the producing rate of 20 years ago.

Drilling. Rumanian drilling operations fall into three phases: drilling areas, technical activities and planned footage.

• **Drilling areas**—Moldavia Oil Trust reported Feb. 14, 1956, that "only 36,960 feet of drilling was accomplished in the oil region of Moldavia from 1900 to 1944."

In the period from 1950 to 1955, drilling increased by 248 percent and in 1955 crude production was 48 times greater than in 1948."

As to future plans, the report said "a 26 percent increase in drilling footage is to be reached during 1956 over that of 1955, drilling speed is to increase 23 percent and labor productivity by 18 percent."

The commission of four new UZTM (Soviet) type drilling rigs (each using five diesel engines) was planned for the third and fourth quarters of 1956. Turbo drilling was to be extended to up to 80 percent of all 1956 footage.

Another report said that 222 oil and gas wells were drilled during the past two and a half years, as compared with 29 wells drilled from 1900 to 1944. Each of the 29 wells was drilled in two to three years to depths of about 1650 feet. Now, wells reportedly are being drilled below 3200 feet with turbo-drills in less than a month.

Work productivity in the Moldavia fields was increased by 59.7 percent in 1955 as compared with 1951. Moinesti fields are the leading ones within the Moldavia Trust district. However, Oltenia is described as the leading "new" field drilled since the end of World War II. Drilling has continued at Oltenia since the discovery well was brought in during 1954.

Pitesti, Oltenia's neighbor, also is a "new" field. Started during 1951, Pitesti has been under exploration since 1948. The first well began producing during April, 1952. A drilling record of 25,080 feet per month has been reported.

Extension of existing fields in Prahova valley was reported on Dec. 14, 1955. In addition to Prahova valley, where turbine drilling rigs are in the majority, Cimpina Trust No. 1 is busy at the Tintea field with Russian turbodrill rigs. Drilling speed there is said to have exceeded that of ordinary rotary rigs by 430 percent when combining the turbodrill method with clear water flushing in rock formations. Cimpina, the field which celebrated its centennial last year, reports that its drilling quota for 1955 was reached on Nov. 22 due to higher drilling speed.

Targoviste, the field which was declared depleted at the end of World War II, was reactivated in 1947. While the older wells are producing very little, new wells are successful. Targoviste's production rate is climbing due to the deeper wells drilled during and after 1954.

In the Bercea area, drilling efforts succeeded in reaching only to 61 percent of the goal. Lack of coordination between transportation and drilling crews, inadequate overhauling of drilling rigs, failure to control drilling mud, waste of materials, lack of interest, and badly-organized Socialist work contests were reasons given for the failure at Bercea.

Boldesti Trust's drilling office also was under heavy fire for not having fulfilled its drilling quota. The primary reason for this failure was absentee-ism. Attendant factors were lack of responsibility, waste, accidents, damages, deterioration of roads, etc., which are credited to the "lack of a systematic political education of the masses."

• **Drilling Methods and Equipment**—Turbodrilling was introduced into Rumania's Moldavia field, the first ever to use this equipment in Rumania, in February, 1952. From there, turbo drilling spread, via Zemes, to almost every field in Rumania.

Moldavia reports that 64.4 percent of all wells were drilled with this method, with the further claim that use of this method brought a 35 percent increase in productivity and an 18-25 percent reduction in drilling costs.

Another drilling practice, introduced in Rumania by the Russians in connection with the turbodrill, is dual drilling. The first dual hole operation started June 26, 1955, at the Moinesti field (Moldavia) and by July 4, 1955, had reached a depth of 1640 feet in each hole.

On the basis of incomplete reports emanating from the Soviet Bloc concerning dual drilling, one derrick, one rig and one crew are used. Two rotary tables and separate drive units complete the rig. When it is necessary to replace a worn bit, the kelly is removed and set back. Then, the first stand uncoupled from the string is rigged with a new bit and the required number of drill collars. From this point, the drill pipe is run in the twin hole rather than being racked in the derrick. In this manner, trip time is reduced since racking is unnecessary.

The 1946-founded SovRum-Utilay Petrolifer (Oil Equipment Monopoly) started the Rumanian fabrication of equipment, machines, engines, electrical and mechanical gear. The two major drilling rigs manufactured are the August 23 and the May 1st units.

The first complete rig was a 142-foot derrick with a rotary table and transmission with a maximum speed of 384 rpm on the table, two diesel engines with 190 hp horsepower each, two mud pumps, a metal dog house, crown block, shale shaker, blowout preventer, various bits, required pipe, etc. Capacity of this rig was 6000 feet with 4½-inch drill pipe. Soviet blueprints were used, but Rumanian engineers from the Projecting Institute of the Ministry of Oil Industry and the Ministry of Metallurgical Industry participated in the Rumanian production.

During 1953, Sovrum-Utilay Petrolifer reported that manufacture of a 10,500-foot rig had been started in Rumanian factories. This rig is fitted with pneumatic controls and is powered by five diesel engines having a total horsepower rating of 1500. This rig was said to be the first exclusively Rumanian rig, and it became available for export sales, as well as for domestic industry, during 1955.

The first turbo drilling rigs were manufactured under Russian control in 1953. The First of May rigs were built with Soviet blueprints—the first occasion where Russia permitted a non-Soviet company to manufacture the drilling rig.

The last report received on oil equipment was dated Jan. 18, 1956, and came from Bucharest: "The First of May Factory of Ploesti now delivers drilling rigs either with steam or electric power the Soviet Rumanian T-1800 type, and the Soviet BU-40 type. During 1955, the first deep-drilling rigs, called the '3200', were delivered. The latter rigs are to be sold to the Chinese People's Republic, to East Germany and to the Korean People's Republic. It was planned that production of drilling rigs would increase during 1960 to 400 percent of the 1955 level."

• **Footage Drilled**—About 60 percent of the total footage drilled in 1953 was for exploration, 40 percent for field development. This ratio was reported by Minister Dumitru.

Contradictory footage data are circulating throughout Western Europe, as indicated in Table 2.

TABLE 2
Footage Drilled in Rumania—1937-1955
(In Feet)

YEAR	Feet	Year	Feet
1937	1,292,650	1945	482,283
1938	944,882	1946	439,633
1939	859,580	1947	534,777
1940	803,806	1948	1,049,869
1941	830,053	1949	1,574,808
1942	1,128,609	1950	2,132,546
1943	1,118,766	1955/P	4,101,050
1944	482,283	....	.....

P means planned. For 1955 plan included 2,296,588 feet in development wells and 1,804,462 in exploration drilling.

The 1955 figure in Table 2 clashes with the statement concerning the 60-40 ratio of exploration/production, made by Minister Dumitru, as well as another Rumanian statement that "during 1952, 353,100 feet was drilled."

On the other hand, the footage figures reflected in Table 2 may be possible if Russian and Rumanian claims on increases in drilling speeds are correct.

An increase of between 55 percent and 60 percent was scheduled for the next Five-Year Plan (1956-1960) over that of the First Five-Year Plan (1951-1955). The 1955 increase in footage drilled is said to have amounted to 133 percent over that of 1950. This work, according to the Rumanian press, is "too slow in a number of regions."

A major complaint was aired by the Rumanian press: "Due to the weak organization of labor in the repair and maintenance brigades and due to the

fact that they are not properly supplied with the necessary tools and equipment, valuable time is being lost at many oil wells in connection with repair work. At the Cimpina and Targoviste oil trusts alone, during the first three quarters of 1955, a total of more than 40,000 hours of stoppages for repair were allowed. Party organizations are called upon to explain to oil workers the great importance of increased oil production. They must deal properly with the problems of the oil industry and must help in spreading advanced technical methods."

In the Moldavia area, work productivity increased during 1953, compared with 1951, by 59.7 percent.

Pipe Lines. Total pipe line capacity in Rumania was listed at 13,011,250 barrels in 1950. A 150 percent increase was planned so as to reach a total of 19,331,000 barrels capacity by 1955. The new Five-Year Plan calls for another increase: during 1960, pipe line capacity is scheduled to reach 37,175,000 barrels yearly.

Oil pipe lines completed in 1954 connect Ploesti field with Turn-Severin and Odessa. During 1955, a crude pipe line was planned and begun to link Campina and Ollenitza-Danube river.

The largest increase has been recorded in the field of gasoline. It appears that Rumania is permitted by the Council of Mutual Economic Assisitance to retain most of its gasoline, and everything above the 10-million-barrel level of domestic consumption is exported.

Natural gas plays a major role in primary energy supplies. And a second gas pipe line from Transylvania has been planned for completion during the 1956-1960 Five-Year Plan. This 1250-mile pipe line will permit extension of lateral lines up to 62 miles.

During 1956, 12 miles of main gas line was scheduled to be constructed. Earlier plans (1949) had called for two smaller projects—one pipe line from Sincasi to Zame, another from Mediash to Copsa Mica.

Meanwhile, a tabulation that compares the 1955 and 1950 level shows that natural gas trunk pipe line distance was increased by 64 percent, lateral lines by 170 percent and customers by 161 percent. Compared with 1944, 400 percent more natural gas pipe line mileage was available in 1955. Compared with 1950, the percentage rise amounted to 100 percent.

Oil pipe line construction companies have received the following directive: "Provision will be made for the construction of main pipe lines for the transportation of at least 37 million barrels of crude per annum from the new petroleum regions to the refineries, and the transportation capacity of oil pipe lines will be doubled."

Refining. It was planned to build five refineries along the Rumanian sea coast, to increase the charging capacity of the Constanzy refinery to 6,319,750 barrels a year, and to build a new refinery at Gorja (in Oltenia, near Targa Jiu). Total number of refineries is scheduled to reach 75, with a total throughput capacity per year of 26,022,500 barrels. However, this report is questionable.

Exploration. Exploration activities for the past ten years have centered around the Oltenia and Moldovia regions. Pitesti is the most promising section of the Oltenia region; it was first drilled in the fall of 1951 and is producing. With some oil structures proven, exploration there is moving northward.

Moinesti, producing since 1953, is the site of the most extensive exploratory drilling. Operations there are aimed at trying to increase the already proved reserves.

During 1955, Rumanian oil reserves increased almost three-fold from the 1948 level, according to a Dec. 14, 1955, statement released by Deputy Minister Horatiu. He said that "at present exploratory drilling amounts to more than 50 percent of the total drilling being carried out."

Agerpress, the Rumanian monopoly news agency, reported that due to extensive exploration efforts, reserves equal two years of full production, i.e., about 148 million barrels to 163 million barrels, were discovered last year. No information, however, was given as to the location of new reserves, but it appears certain that reference was made to Oltenia, Pitesti and Moldavia's Lucacesti oil fields.

Exploration work also was being conducted in the old producing district of Prahova valley. There, 1955 efforts are claimed to have shown "interesting results," probably through deep drilling.

Directives for the Second-Five-Year Plan (1955-1960) call for an increase in exploration drilling of 55-60 percent over the previous Five-Year Plan. It was emphasized that "exploration is to be extended into new regions."

In the field of natural gas exploration, extensive work was scheduled to be conducted in the Cluj (Klausenburg) area, in the Ploesti fields, in the area of the "Autonomous Hungarian Region," and around Stalin (Kronstadt) village.

A 104 percent increase in exploratory drilling in 1956, as compared with 1955, was planned.

Economics. The oil industry is the hub of Rumania's national economy, although Rumania itself does not profit from its oil at a world market price level. Russia "buys" Rumanian oil at cut rates, thus depriving the Rumanians of considerable revenue.

In return, Rumania assumes all responsibilities that go with the illegal expropriation of U.S., French, British, and Dutch oil companies, in addition to winding up with the former German oil companies which the Soviets renounced in Rumania's favor last fall.

The heavy hand of the Soviet Union still is felt on Rumanian oil: not only have the oil deliveries to—and for the account of—the Soviet Union have absolute priority, but also the Soviets also fix the prices for the oil they buy.

Part of Rumanian oil must be shipped to Russia, or to other countries on Soviet orders, entirely without payment, i.e., as compensation for the Soviet share in SovRum Petrol and SovRum Utilay Petrolifer.

This would mean that Rumania has many years of financial obligations lying ahead. And investments will be slowed down, too, and therefore, production increases will not be as spectacular as in the past.

TABLE 3

Natural Gas Production in Rumania 1938-1960*

(Gas Production in Million Cubic Feet)

Year	Natural Gas Production in Rumania 1938-1960* Gas Production in Million Cubic Feet
1938	65,684
1945	46,050
1946	47,038
1947	41,529
1948	44,496
1949	55,620
1950	69,428
1951	90,616
1952	.....
1953	118,162
1954	123,600
1955/P	137,726
1955	135,824
1960/P	353,144

P means planned.

* The 1953, 1954 and 1955 figures were calculated on the basis of the Statistical Bureau's reported daily increases as compared with the respective preceeding year.

Czech Oil Suffers Through Lack of Russian Interest

Nation has shown the least progress of all Eastern bloc countries in production of petroleum. Lack of equipment, technical know-how and exploration funds have hindered development.

SINCE FEB. 25, 1948, Czechoslovakia has been a Communist-ruled country faithful both to the Stalinist and the new Bulganin course. Its 14 million inhabitants, occupying an area of slightly more than 19,000 square miles, live in the three provinces of Slovakia, Bohemia and Moravia. Liberated from the Germans in the period from the winter of 1944-1945 to May 4, 1945 by the Red Army, the Czech Communist party deposed President Benes in a coup d'etat and caused the death of Foreign Minister Jan Masaryk, Jr. The latter was the son of the man who founded the Czech Republic in 1918.

Since 1945, Czechoslovakia has ranked as the most industrialized country in the Eastern bloc, and has given itself over to Soviet domination politically and economically.

It is the only satellite country that had a "government production plan" before the Communists assumed control. A Two-Year Plan (1947-1948) was followed by a Five-Year Plan (1949-1953), and by two individual One-Year Plans (1954 and 1955). The two one-year plans succeeded the First Czech Five-Year Plan in order to permit synchronization with the Soviet (Fifth) Five-Year Plan, lasting from Jan. 1, 1956, to Dec. 31, 1960.

Before the Communists took over, the principal undertakings of Czech industry were nationalized. Currently, about 99 percent of all industries are fully nationalized. The oil industry, suffering under a "low" in output at the end of World War II, was nationalized on Oct. 28, 1945.

Drilling. The fact that Russia does not take part in Czech oil and shows no interest at all has resulted in severe difficulties. Lack of equipment, insufficient knowledge of techniques and modern methods and lack of funds for exploration have hindered development.

Oil production-wise, Czechoslovakia has shown the least progress of all other Soviet satellite countries. No drilling footage figures have been announced either as planned or as completed. Nor have any totals on oil and/or gas wells been made public.

However, Western observers believe two factors have hindered progress:

- Geological mapping and exploration work was conducted in too many areas for the amount of equipment available.

- The number of drilling rigs was so few and their condition so poor that a drilling bottleneck resulted.

Czechoslovakia manufactures mostly processing and transportation equipment and very little drilling and production equipment. However, seamless pipe from Vitkovice Iron and Steel Works is produced in such quantity that all domestic needs are met, with enough remaining for sizable exports.

Russia has shipped several Uralmash-5-D drilling rigs into its westernmost satellite. These rigs are capable of drilling to a reported depth of 11,500 feet. Also, several BU-20 and BU-40-type shallow and medium-depth rigs, which are jointly used by the oil and coal and ore exploration crews, have been supplied by the USSR.

The only actual statement issued on drilling appeared in the Jan. 5, 1953, issue of Rovnost, a Brno daily newspaper, which reported: "More wells were drilled near Gbely (Slovakia) also in the Moravian-Slovakian border districts and south of Brno in Moravia province. A short time ago, geologists' trucks were parked where derricks are now standing.

Production. Output is insufficient to fulfill domestic requirements without imports. The 1955 production plan definitely was not reached. The crude production quota prescribed for the last year of the First Czech Five-Year Plan (1953), amounting to 1,354,000 barrels, was not reached as late as 1955. Vienna sources revealed that the 1954 production of 1,259,220 barrels was only slightly exceeded in 1955, and that production was below the 1,354,000-barrel mark.

Since conflicting statements have been received concerning Czech crude production, Table 1 shows all available reports. Actual data in barrels or metric tons almost are never given. If the data of former years are known, future output almost invariably is given in percent.

TABLE 1
Estimates of Czechoslovakia Crude Oil Production

YEAR	Group A*	Group B**	Group C***	Czechoslovakian Plans
1937	128,630	130,661	.....	.....
1942	.....	245,751	.....	.....
1945	90,718	90,718	.....	.....
1946	197,007	142,847	.....	.....
1947	270,800	270,800	365,580	.....
1948	331,730	338,500	555,140	.....
1949	406,200	406,200	.....	.....
1950	426,510	426,510	541,600	.....
1951	507,750	507,750	880,100	.....
1952	771,780	744,700	1,340,460	832,710
1953	832,710	913,950	1,624,800	1,354,000
1954	947,800	.....	1,259,220	.....
1955	1,117,050	.....	1,876,644	.....

* Figures are from West Germany's Economics Institute, except for the 1955 estimate which stems from private circles.
** Figures from the United Nations Yearbook of 1954. It will be noticed that the difference between Groups A and B are but slight.
*** Figures are from Czechoslovakian, Soviet, and West European figures.

For example, Party Secretary Jodef Tesla announced Dec. 30, 1952, that the 1955 output would be 25 percent above the 1952 level. And for 1952, three production figures had been reported: 771,780 barrels, 1,340,460 barrels and 744,700 barrels. The 25 percent increase would make the 1955 production plan on the order of 964,-

725 barrels, 1,675,575 barrels or 930,875 barrels.

Under these conditions, it is practically impossible to select a precise figure. However, certain figures become more believable than others when the industry's development is followed closely over several years.

The only production plan that apparently was fulfilled ahead of schedule was that of 1952. The annual plan was fulfilled, it was reported, in the first ten months. With the production goal set at 832,710 barrels for 1952, the surplus output amounted to two months' production (166,542 barrels), thus boosting the entire 1952 production to 999,252 barrels.

According to the Communists, the 1955 production target was 999,252 barrels plus 25 percent (249,136 barrels), or a total of 1,248,388 barrels. This figure can be regarded as the approximate 1955 production, despite claims that 1,259,220 barrels of crude was produced during 1954.

To further complicate matters, the revised plan called for 1955 production of 1,354,000 barrels—the same as the intended but never-reached 1953 goal—but which was not fulfilled. While the Central Statistical Bureau of Prague announced all "positive" production figures (those where the plan was fulfilled or exceeded), the oil industry was not mentioned.

Consumption. Domestic consumption amounted to about 2,708,000 barrels of products during 1938; the 1950 figure reached 4,739,000 barrels and that of 1954 was put at 5,416,000 barrels. A 6,770,000-barrel mark is believed valid for 1956. Of that amount, about 50 percent is being supplied by the expanding synthetic liquid fuels and lubricants industry, 20 percent by the Czech oil industry and 30 percent by imports.

Pipe Lines. It is believed that the wartime-built pipe line from Austria's Zistersdorf oil field, which was partially dismantled on the Austrian side, still is intact from Gmuend to Tabor, the site of a refinery begun but never completed.

Shorter lines which carry natural gas are reported from Malacky, Stupava and Senec.

A major project for the immediate years ahead is the construction of a gas pipe line system reaching from the West Slovakian fields around Hodonin/Malacky to consumers farther east. Starting from Trnava during 1956, a 50-mile pipe line will connect the villages of Neustadt/Waag, Trencin and Dubnica. Another branch is to start at Dubnica and extend to Zilina (Sellein) and Trzyniec on the northern part, and to Nitra, Prievidza and Ziar on the southern route.

Natural Gas Production. During 1952, natural gas output was described as 7.7 times greater than the 1932 production of 31 Mmcf. If that is correct, 1952 gas output reached 247 Mmcf, which is impossible.

The statement regarding the increase in 1952, made by the late President Clementis Gottwald, must be incorrect, for several qualified Western sources put gas production at the following levels:

1938 and 1945—17.6 Mmcf.
1946 through 1951—70.6 Mmcf.
1952 through 1955—77.6 Mmcf.
The 1955 amount is estimated.

Exploration. The government's crude production plans have forced an acceleration in exploration activities. While the efforts have centered around existing fields, they also have branched out recently into other areas.

The principal area of exploration remained along the Austro-Czech border, reaching from Tabor, in western Moravia, to the area south of Brno, and from there southeast from Gbely, Hodonin, Lundenburg and Stefanov, thence to Malacky and Lusice.

Moravian province exploration is being conducted by the state monopoly company Morawske Naftove Zavody Podnik, headquartered in Bratislava.

Complete secrecy has shrouded results of exploration in the Plzen, Pardubice, Hradec and Kralova areas at the south of Morava province surrounding Znaim.

Geophysical. Latest news in this field of oil operations was the 1953 report that the Clementis Gottwald Prize has been bestowed on a geologist for the discovery of oil traces in the Tatra moutains in eastern Slovakia.

Economics. The primary energy balance in Czechoslovakia swings overwhelmingly to hard coal. Both natural and synthetic liquid fuels and natural gas furnish less than 15 percent of total domestic demand. Russians, more interested in quick results, have assisted the Czech coal industry by training Czech miners in the various Soviet speed methods. High productivity equipment from Russia was sent to the Ostrawa coal center. No help was given the oil industry.

Complete disregard for civilian needs reduces requirements, of course. Armed forces, Communist Party chieftains and nationalized companies receive the lion's share. With annual increases in expansion of economy not exceeding 10 percent, petroleum requirements can be met easily through the low domestic output, synthetic oil industry and imports. And the very high percentages of exports, measured against total production, can easily pay for these imports.

Imports and Exports. The 1955-1956 import total was expected to approximate 2 million barrels. Of this volume about 1.6 million barrels will be crude and the remainder products. Most of the imported crude is from Austria, but a portion is imported from Hungary. In addition, some Rumanian natural products and East German synthetic products are imported.

While Czechoslovakia exports no crude oil or products, the country is engaged in an almost world-wide refining equipment export business. Also a major product for export trade is Czechoslovakia's seamless pipe, which is traded to the West and to all Eastern bloc countries. Prague claims that pipe exports pay for required oil products imports.

Forecast. Czechoslovakia certainly is not an oil-rich country, but it could produce more oil than the present rate if sufficient interest were developed. This lack, together with insufficient funds and general fatalism and ignorance, keeps the industry at a low operating level.

The oil industry is generally believed to be the least ambitious branch of Czechoslovakia's entire industry.

No immediate change lies ahead. Only the rather accidental discovery of a major nature could awaken the Czech economic planners to the industry's needs and its problems. On the other hand, Czech export goods sell well enough on the international markets to make the Prague government doubt the need of investing heavily in its own oil industry. Especially, as long as sufficient oil can be had through normal trade channels and without risk.

That, then, is the viewpoint of government planning that kills private initiative.

Natural Gas East Germany's Brightest Immediate Hope

While the oil industry appears likely to expand along the border with West Germany, synthetic fuel and lubricant industry—one of Europe's largest, is expected to draw more interest.

DEVELOPMENT of the oil and gas industry in East Germany is expected to be a very slow process due to an absence of sufficient material, trained personnel and modern techniques. No East German trainees have been reported as yet to be studying Russian material and techniques, whereas all other satellites have been permitted to send technical representatives to Russia for briefing.

The natural gas industry has the best chance for development since two large deposits have been found. However, utilization of these deposits depends on pipe lines and distribution. The possibility of development is further hindered by the location of the gas wells which would require long pipe lines.

The oil industry is likely to expand, especially along the border between East and West Germany. But the synthetic fuel and lubricant industry, one of Europe's largest, will draw the major interest for a long time.

Political. East Germany is a Soviet creation and was formed from the Soviet zone of occupation. The German Democratic Republic was proclaimed on Oct. 7, 1949, as a result of the Western allies' proclamation of the German Federal Republic, but "full sovereignty" was not granted to this newest Soviet satellite until March 25, 1954.

East German sovereignty is theoretical, for all political and economic decisions are made in Moscow and not in Pankov, seat of the East German government. East Germany has not yet declared itself a "People's Democracy," a little and insignificant detail.

This country's 18.5 million inhabitants, living on 41,537 square miles, are dominated by the Socialist Unity Party-SED, a Communist merger of the German Communist Party and the East German Socialist Party. The U. S. did not recognize the East German government because both government and deputies for the two-chamber parliament were appointed, not freely elected. The SED is firmly rooted in the state. The last election result published by the Communist government declared 99.86 percent of all valid votes to be in favor of SED.

Uprisings of June 15-19, 1954, however, proved that the number of East Germans opposing the regime is greater than the East German government wants to believe.

This political situation reflects directly onto the economic life in East Germany:

A Two-Year Plan (1949-50) was the forerunner of planned economy. It was followed by the First East German Five-Year Plan (1951-1955) and the Second East German Five-Year Plan (1956-1960).

Oil was not mentioned directly in the production plan explanations. Only in a general way was "utilization of liquid mineral fuels" mentioned. The output of synthetic liquid fuels was ordered to be stepped-up for that part of the industry that had remained in East German hands.

Majority of the synthetic plants, however, were either dismantled by the Soviets from 1945 to 1949 or else remained in the hands of a Soviet administration that operated these undertakings for Soviet use and profit. The Soviet Union has not yet participated in East Germany's efforts to find new oil deposits or to expand the small fields currently operating.

Drilling. Subsequent to an announcement in 1950 that all oil operations would be nationalized, these groups were organized:

- The former Deutag drilling property at Aschersleben was nationalized without reimbursement, as was the Gebhard & Koening Drilling Company of Nordhausen. Both companies were combined into the Vebausruestung (peoples-owned equipment firm), with headquarters divided between Aschersleben and Nordhausen.
- Oil industry experts were concentrated in the Veb-Geologische Bohrungen (geological drilling) company headquartered in Leipzig.
- Various smaller companies were affiliated with the Veb Schachtbau, also headquartered in Leipzig.

These three organizations, plus the Geologischer Dienst (geological services) were connected under State Geological Commissions jointly supervised by the ministries of Interior and of Heavy Industry and Mining at Berlin. A central administration for the Geological Commission was set up in Gommern, near Magdeburg.

A smaller branch of the geological drilling company is located at Schoenebeck, on the Elbe river. Field offices are spread throughout areas where mapping, drilling or production operations are conducted.

Drilling sites, reported from 1952 to Dec. 31, 1955, were listed at:

1. **Thuringia**—where the Schoenebeck drilling company had the only rotary rig during 1949. The rig was useless until 1950 when some long-abandoned parts were found.
2. **Ludwigslust district**—where five shallow holes were drilled by the first half of 1952. Five small drilling rigs were available there.
3. **Ettersberg-Weimar area**—where at least three wells were drilled between 1954 and the end of 1955.
4. **Langensalza**—where more wells had been planned for 1955 completion with two medium Soviet rigs each capable of drilling a maximum of 10,000 feet.
5. **Ufftrungen**—where a test well was drilled near Nordhausen in the southern Harz area. No results were reported.
6. **Fallstein**—where new development wells have been drilled since

1954. Area is described as one of the "most promising" in East Germany.

7. **Berlin-Ruedersdorf**—where late in 1954 a test was under way. No results available.

8. **Mecklenburg province** near Werle—where four rigs were in operation by July, 1955.

9. **Waddekath/Salzwedel**—where on the East German side (this area is across the border dividing West and East Germany) wells were spudded in during 1954 with plans for more to test further a known oil horizon at 132 feet.

10. **Koenigswusterhausen**—where three rigs were drilling late in 1954.

11. **Kirchheim-Dobbelung**—where one drilling rig was operating.

The Waddekath and Koenigswusterhausen wells were drilled by rotary rigs of the Abus type turned out by the East German Technical Bureau for Mining Machinery at Leipzig. In addition to these and an undisclosed number of Uralmash and BU type rigs which East Germany bought from Russia, one KM-250 rig and one KM-500 rig are available for use in East Germany.

Small, isolated drilling sites are located in Peckensen (Altmark), Volkenroda (Thuringia), Zechstein (Thuringia), Schmoelau (Altmark), and Muehlhausen.

Production. The only pre-war producing field in the territory that makes of East Germany today was in the area containing the Fallstein wells. Production increased, according to Western sources, from five barrels a day in 1952 to about nine barrels daily last year, indicating the existence of a second producing well.

Fallstein produced from 1937 to 1940 and was reactivated during 1950-1951.

Another, though small, producer is at Volkenrode. The well was reactivated in 1952 and increased its yield. However, since 1954 it has been declining. In the Zechstein area, which produced about 360,000 barrels of oil in 1930, the well Ettersberg 1 found oil after the war. It has been producing at the rate of about 85 barrels daily.

Post-war drilling has been mildly successful. In Langensalza, two wells were producing by the beginning of 1955, each with daily output of about 15 barrels. Oil was discovered there after a gas blowout halted drilling operations during May, 1952. The gas came from 5280 feet, and the oil horizon was found at 6600 feet.

Drilling activity also was successful near Salzwedel, probably at Waldekath, where a 132-foot oil sand was found at 5085 feet.

These two wells have a combined ouput of 425 barrels daily.

New Field Discoveries. The following new producing areas have been found since World War II:

- Ettersberg (Thuringia), where Ettersberg 1 (probably near Zechstein) found oil at 6270 feet and was producing about 85 barrels a day. There was no indication that more than one well was on production.
- Waldekath (Mecklenburg/Brandenburg), where two wells reportedly discovered oil at 5085 feet during 1954. Each of the two wells reportedly was producing slightly more than 200 barrels a day at the beginning of 1955.
- Langensalza (Thuringia), where natural gas was found at 5280 feet and a little oil at 6600 feet. Reserves there were estimated at 14 billion cubic feet.

East German Production Estimated for 1955

FIELD	Barrels Daily	Year 1955
Fallstein	9	3,095
Volkenrode	...	...
Ettersberg	85	30,953
Langensalza	28	10,318
Waldekath	424	154,767
Total	546	199,133

It must be borne in mind that even a 200,000-barrel annual crude output would fulfill only about 5 percent of domestic requirements.

Exploration. The original investment fund of $22,727,000 for exploration activities in 1950 was increased to $179,840,000, indicating a growing interest in this phase of operations. However, the funds spent for exploration and drilling decreased to $90,-920,000 for the fiscal year 1954-1955.

Principal exploration areas for the past five years have been:

1. Urbach, Utringen, Ufftrungen, Fallstein, and Zechstein in Thuringia.
2. Kirchhain, Dobbelung and Werle in Mecklenburg.
3. Ludwigslust, Ruedersdorf, Waddekath, and Salzwedel in Brandenburg.
4. Schmoelau and Peckensen in Altmark.

Exploration in East Germany is, like production and refining, handled by a state monopoly under the State Geological Commission, headquartered in Gommern, near Magdeburg. It is certain that the results of prewar and wartime geological work have been collected in East Germany and used as the basis for the present activities.

Whereas the Soviets play the most important role in developing East German uranium ore, no interest whatever has been shown in the oil business. And the slow progress may be attributed to this lack of initiative.

Leasing and Concessions. All concessions formerly granted under the German Reich's Bitumen Act were waived when the oil business was nationalized. No reimbursement was made for equipment taken by the state, and no indemnity was paid for confiscated rights, concessions or leases.

Paralleling the policy in the Soviet Union and other satellite countries, East Germany does not recognize the term "concession" since one state agency thus would permit, in effect, the operation of another state agency.

In practice, the State Geological Commission conducts preliminary studies wherever geological structure warrants. Then the areas are defined more closely by geologists and a "recommendation" for more detailed study is sent to the commission. The latter, in turn, orders geological teams to conduct the suggested study.

The commission merely informs the district mining agencies of the operations intended to be started or already under way by the field parties.

Imports and Exports. East Germany imports oil from Austria and sells products to both East and West Europe. The Austrian crude is not imported under any trade agreement since Austria does not recognize East Germany diplomatically. The compensatory deliveries of Austrian crude to Russia, of course, are used to charge the Luetzgendorf refinery.

West Germany is East Germany's major customer for exports. However, only synthetic fuels and lubricants are exported.

Albania Claims 1955 Crude Output of 1,870,500 Barrels

Government's prescribed 4 million barrel level for 1960 remains unchanged. Shortages of equipment, repair parts and trained personnel plague drilling program.

THE DAY ALBANIA was "liberated" from the German army by the Russian army—Nov. 29, 1944—this 10,575 square-mile area became an exclusively Soviet-dominated country. Immediately, Soviets laid the foundation for the re-establishment of the Labor Party and for the political group which since has assured allegiance of this country and its 1.3 million inhabitants to the USSR.

While Red army units moved out officially on Jan. 11, 1946, when the Albanian People's Republic was proclaimed, Russian interest has never ceased. In 1945, the power of the Communist party under Enver Hodsha was established and all opposition eliminated.

These events are factors in evaluating the economic status of Albania from 1944 to date. Albania belongs to the 1945-Moscow-founded Communist International Economic Bloc organization. As a member, domestic production is subject to Com-Econ planning, and international distribution of its production and imports are governed by the East Bloc Planning Organization. The "red thread" through East Bloc economy for the past ten years has been the "brotherly assistance" given by the Soviet Union to its satellite countries. This assistance has taken the form of equipment deliveries on credit, delegation of Soviet experts as supervisors, and of funds designed to "buy" the Soviets directly into the national economies.

Both political and economic policies have been changed during the past ten years. However, no changes have occurred in the basic Soviet influence, supervision, delivery demands, and rigid discipline.

Drilling. The Five-Year Plan (1951-1955) had called for the drilling of 136,700 feet of exploratory hole and 583,860 feet of development drilling. It is doubtful whether the objectives were achieved because of equipment shortages, lack of replacement parts, and a dearth of trained personnel.

Production. The government's oil production plan amounted to 1,754,736 barrels for 1955. The Statistical Directorate of the State Planning Commission reported that 6.6 percent more crude had been produced than planned, thus establishing a claim to an output last year of 1,870,549 barrels.

No change in the crude production objective was announced. On Dec. 30, 1955, Radio Tirana mentioned that a 12 percent increase in production had been recorded in comparison with 1954. This statement clashes with others.

The first vice president of the Albanian Council of Ministers, Bakir Baluku, said Nov. 29, 1955: "A 484 percent increase over the prewar (1938) output will be achieved during 1955." The United Nations lists Albania's 1938 output at 760,608 barrels. So, according to Baluku, 1955's production amounted to 3,681,343 barrels.

Baluku's statement appears to support West German reports which put the Albanian output at the following levels: 1938—934,080 barrels; 1948—1,494,528 barrels; 1949—2,188,416 barrels, and 1950—2,802,240 barrels.

The West German figures are reportedly official or semi-official Albanian figures. However, validity of these figures appears doubtful since a 159.4 percent increase from 1950 to 1955 was reported Dec. 27, 1955, by Radio Tirana.

Table 1 shows figures which, in the first column under "A," reflect an evaluation in percentages and figures which, in the second column under "B", are those stemming primarily from West German and Austrian media.

TABLE 1

1938-1955 Crude Oil Production in Albania
(In Barrels)

YEAR	A*	B**
1938	760,608	.....
1939	.....	934,080
1942	.....	1,621,296
1947	1,281,024	1,281,024
1948	.....	1,494,528
1949	.....	2,188,416
1950	879,370	2,828,928
1951	1,214,304	.....
1952	1,114,224	2,401,920
1953	1,134,240	.....
1954	1,367,760	3,336,000
1955/P	1,754,736	.....
1955	1,870,561	3,681,343

* Albanian percentages evaluation in comparison with previous years.
** West European sources, primarily from West German and Austrian media.
P means planned.

With reference to Table 1, if Albania had achieved such a drastic increase from prewar production, news certainly would have reached the West during the past years. Russia appears to have withdrawn from the satellite bloc oil business since its own reserves have risen sharply.

The fact of the officially unchanged crude output objective for 1955 and the precise report on the overfulfillment of the Statistical Directorate indicates that the group of A figures in the Table 1 are nearer actual production than the B group.

The 4 million barrel level prescribed during 1952 for 1960 remained unchanged.

Pipe Lines. A 17-mile pipe line connecting Cerrik refinery and Stalin City was almost completed at year's end. Another pipe line—from Kucova

oil fields to the Cerrik plant—was nearing the construction stage.

The only prewar pipe line, connecting Kucova and Vlona (Valona), was repaired after war damage during 1949. This pipe line was built by Azienda Generale Italiani Petroli, the Italian oil monopoly, immediately prior to the outbreak of World War II, when Italy was instrumental in beginning the Albanian oil business.

Refining. The Cerrik refinery, projected during 1950, still has not been officially opened. The plant, erected by Soviet technicians with Soviet equipment, reportedly was designed for an annual throughput capacity of 1 million barrels of crude.

The plant was to have been readied by the end of 1955, but the deadline was changed to July this year. The cracking department began operating during 1955, along with some service departments.

A West European report mentioned three small skimming plants near Kucova, with combined annual capacity of 200,000 barrels. A later report said two processing centers exist at Kucova, with 567,000-barrel-a-year throughput capacity, and at Patos (Pahtosa), with a capacity per year of 433,650 barrels.

Total refining capacity during 1956, therefore, was ranging between 1,200,950 barrels to slightly more than 2 million barrels a year. Annual domestic requirements were estimated to equal 1,668,000 barrels.

Exploration. The oil industry is organized under the Mining Ministry, headquartered at Tirana. All decisions are made by the Council of Ministers, which submits orders to the Mining Ministry.

In turn, the Ministry hands the orders to its Administration for Petroleum Production and Processing Industry and the Marketing Enterprise. The latter agency supervises the 1952-founded Albaruneft syndicate, a joint Albanian-Soviet oil monopoly.

Crude production was begun by Italy in the Patos and Kucova areas. Patos, south of Berat village, is said to have increased its output nine-fold during 1954, as compared with prewar years.

A comparison of the Devoli field production prior to World War II and the 1952 yield showed a 50 percent slump in 1952. Blame was put on forced production by Italy and Germany during the war. However, production rose to an undisclosed level in 1955 "when the arrears of capitalist management were worked off."

The Kucova field, north of Berat, is about equal in production with the Devoli field, which is near the Malakastik mountain: each of them is estimated to have produced about 233,000 barrels of crude during 1953.

The Kucova field was "liberated" by partisans (armed Albanian and Yugoslav forces) on Oct. 18, 1944. The Kravastas fields, in the Fieri district near Maliqu, have been producing since the end of the war and are described as the most promising areas.

In addition to Maliqu and Pekisht, near Pequin, exploratory work reportedly has proven that crude deposits exist along the Devoli river. Both the Maliqu and Fieri deposits are said to be too small for commercial production, even considering the "oil at all cost" policy advanced in countries under the Soviet thumb.

Leasing and Concessions. Prewar and war-time foreign concessions were declared invalid during December, 1945. No new concessions were awarded, but the state in claiming all natural resources retained the right to permit its own companies (state-owned, managed and controlled) to work in assigned areas.

The principle of "assigned areas" is maintained to keep development work of the various companies from overlapping and wasting funds and efforts.

These companies received their areas by the Petroleum Administration of the Mining Ministry. Since cooperation exists between Albania and the Soviet Union (through the Albarusneft syndicate), both Albania and the Soviets cooperate from exploration to refining. It is only after the refining stage that the Soviets dominate the operations.

Imports and Exports. Albanian exports are made up of crude oil only. Domestic refining capacity has not yet been able to satisfy domestic demand. While there is an over-production of gasoline, there is a shortage of lubricating oils of higher quality; there is sufficient asphalt and diesel fuel, but a shortage of kerosine.

Since crude production exceeds available refining capacity, it is natural that mostly crude is exported. However, gasoline and asphalt are exported in smaller quantities.

Exports so far have been made to Italy and Yugoslavia, but early in 1946 there was a record of Albania offering asphalt to Austria. While crude is exported directly to Russia, it is likely that the oil is re-routed later to either Poland or East Germany.

Imports are negligible. Rumania formerly exported oil products to Albania, but in 1955 the exports apparently stopped.

It is interesting to note that Yugoslavia has been "accepted" by Albania's government again. After the 1948 break between Marshal Tito of Yugoslavia and the Cominform, Albania observed the same hostile attitude toward Yugoslavia as did Russia and other satellite countries. Yugoslavia worked with Albania from 1944 to 1948 to repair Albania's oil fields, but this assistance was overlooked by Albania's Stalinist government from 1948 to 1955.

Labor, Housing, Roads. Talented Albanian oil workers are sent to a four-month training course held continuously at Stalin City. Engineers reportedly are being trained in Russia.

Oil industry personnel have been labeled "most important workers," thus pointing directly to the "responsible job of oil workers in the establishment of socialism" in Albania. The overall Soviet tendency is to build camps around major production or processing sites. Albania is following this trend by building a camp around the Cerrik refinery, where 1000 apartments were scheduled to be erected. A movie house, a "cultural palace" where political meetings will be held, a school, kindergarten, commissary, bank, and hospital also were planned or under construction.

A similar camp also has been planned for Patos field, where a settlement for 800 workers was established a few years ago.

Russian engineers built 240.4 miles of new roads and reconstructed about 100 miles of war-damaged roads from 1945 to 1955. Total investment for this road construction program was $29,520,000. During 1952 alone, 115 miles of roadway was built.

The total number of vehicles in Albania can only be estimated at 3000 automobiles, taxicabs, trucks, armed vehicles, motorcycles and motorboats.

Yugoslavia Accelerates Its Exploration Activity Rate

200-barrel-a-day producer brought in during 1955 near Velika Greda, but shut in pending construction of pipe line facilities.

SINCE 1948 Yugoslavia has followed a political course that has been most profitable for its economy. From 1944 to 1948, the Soviet Union and its satellites assisted in the development of Yugoslavia's economy; from 1948 to 1955 assistance from the Western Powers—U. S., Great Britain, France, West Germany, Austria, and Italy—replaced that from the East. Since 1955, however, the nation has been receiving both Western and Eastern aid under its declaration of "neutrality."

This stand has resulted in an independence from the Kremlin's rule on one hand and a refusal to join the Western group of free countries.

The 19 million inhabitants, living on 66,002 square miles of land, are governed by a non-Stalinist Communist party replete with the political and economical trappings of a militant, state-minded group that is adverse to individual private initiative and freedom. Proof of the grave discontent within Yugoslavia is the number of refugees seeking asylum in Italy, Trieste and Austria.

Yugoslavia formerly was a member of the COM-ECON (Eastern bloc), but severed its membership when Tito broke with the Kremlin in 1948. So none of the restrictions of the Eastern bloc economic concept are dominant in Yugoslavia, and trade with both East and West is sought freely.

This position has resulted in a relatively rapid development of the oil industry during the past ten years. In that period, crude production has risen tenfold and exploration activities have brought favorable results.

Drilling. Each of the republic's federated states has its own oil monopoly. Operations conducted by four of the five major monopolies follow. The fifth, Naftagas of Belgrade (Serbia) reportedly is conducting operations in the Nish-Danube river area, but no details have been reported.

The remaining four companies and their operations are:

1. Naphthaplin monopoly, headquartered at Zagreb, is the largest and best organized oil company in Yugoslavia. It controls the nation's best fields (Croatia), which produced almost two-thirds of the 1955 output of 1,735,800 barrels. Its operations include:

- Expanded twin drilling—the practice of drilling two wells simultaneously with one rig and two rotary tables—operations which are credited with reducing cost per well and with increasing footage drilled. This practice was begun at Gojlo, near Brdo, in 1952. In one case, twin wells were drilled 4737 feet and 2904 feet, in 84-plus days and 21-plus days, respectively.
- A drilling program, now in its fourth year, which brought Croatia's biggest oil field—Klostar-Ivancic—into production. Reserves there are estimated at approximately 6,750,000 barrels.
- A total of 85,800 feet was drilled during the first half of 1954. Wells in the Klostar-Ivancic field were drilled to a maximum of 4920 feet, with oil horizons of up to 40-foot thickness at 2475 feet and 3940 feet.
- Discovery of natural gas at Lipovac, the closest village to Klostar-Ivancic field, during 1955 at a depth of 1805 feet.
- Naphthaplin also reported drilling operations at Dugo-Seol, about 12.5 miles east of Zagreb. Initial oil traces were found at 4100 feet in 1953, and accelerated drilling was reported in the area during 1954 and 1955.
- Deep drilling operations in the Sitnice area on the Mur river island of Medjunerje.

The first wells were drilled there between 1911 and 1939. While part of the area is producing (cumulative production: 405,000 barrels), more and deeper drilling has been ordered. Natural gas horizons have been reached at 8860 feet, but wells are scheduled to be drilled to 9842 feet. In addition, traces of oil have been found at Peklencia area, on the Mur river island.

Other drilling sites in Croatia are centered around the following villages:

Moslavina mountains, near Osekova, where gas wells have been drilled to 8202 feet; between Sava and Drava rivers toward Zagreb in an eastern direction to Nova Gradisca; near Resnik, three miles east of Zagreb at the Zagreb-Belgrade superhighway; Vrbovac; Dubranec; Navaska; and Janja Lipa.

Sixteen modern rigs reportedly were in operation in these areas during 1955, two of which are capable of drilling below 10,000 feet.

2. The Slovenia Naphtha monopoly operates around Kakanj, about 31 miles north of Sarajevo. In the Voivodina district extending from Belgrade to the Rumanian and Hungarian borders and in the Slovenia part of Donja-Lendava, drilling has been reported during the past three years. Drilling also was under way in 1955 in Ulcinj and Brcela, where work began in 1952. Successful operations have been reported in Jermenovci, where wells were shut in pending construction of transportation facilities.

However, it can be assumed that most of the wells drilled at the Dolnje-Lendava and Mramor Brod areas will increase the natural gas production of Slovenia, rather than the crude yield.

Latest drilling operations were being conducted near Ludbreg in the Waradin district, where production was found before World War II.

3. Bosnia also is being worked by a company named Naphtha. Headquartered in Pozarmca, this firm is a typical shallow drilling undertaking, with wells reaching 1640 feet to 2625 feet.

4. Naphthabrno Gora monopoly of Montenegro, headquartered at Petrovar, is using U. S., German, Italian, and Yugoslav drilling rigs in opera-

tions near the Albanian border. Prior to 1948, this firm had assisted Albania in development of Devoli fields. Now, however, only limited drilling operations at undisclosed sites are continuing. Ulcinj was the drilling center during 1954 and 1955.

Yugoslavia's increase in crude production has been correctly attributed to its expanded drilling program, financed by the government. During 1949, footage drilled was twice the 1948 level. This record occurred at the time when Tito's break with the Kremlin had its more severe consequences—no eastern deliveries of material were made and the West was not then prepared to fill the gap.

A Yugoslav report said the number of wells producing from 1947 to 1951 were: 1947, 24; 1948, 72; 1949, 162; 1950, 274; and 1951, 389.

Production. Yugoslavia raised its crude production from 7424 barrels in 1938 to 1,735,870 barrels during 1955. Reasons for this upturn are twofold: development of Croatian fields by German occupiers during World War II and intensification of operations conducted under Marshal Tito's government from 1951 forward. Western assistance played a major role in the latter phase.

Production data are released by Yugoslavia frequently in actual figures—(see Table 1)—a significant difference between this nation and the East bloc.

TABLE 1
Yugoslavian Crude Production by Year
(In Barrels)

YEAR	Barrels
1938	6,750
1940	8,099
1943 to 1945 (Germans)	404,940
1945	211,919
1946	141,729
1947	224,371
1948	246,325
1949	426,807
1950	744,705
1951	999,750
1952	1,022,723
1953	1,162,178
1954	1,464,533
1955	1,735,877
1955/P	1,754,740
1960/P	5,399,200

/P Means "Planned".

Typical of the difficulties faced by the oil business is the current fate of the Velika Greda oil field: a flowing well there, capable of producing about 200 barrels daily, was shutin pending the construction of a pipe line. And there are other examples.

Donja-Lendava is one of the most productive and promising oil fields in Yugoslavia. Reserves there are estimated at 132 million barrels, or almost a third of the nation's total reserves known at the end of 1955. Natural gas reserves are put at 162,425 Mmcf.

The field's annual crude yield varies, but averages 303,705 barrels. Other fields in production last year were Golje, Donja, Mermerno, Brdo, and Sumecani, in addition to Kutina field which still is the leading producing area, having recorded an output of 1,214,820 barrels in 1954 and 1,417,290 barrels in 1955.

Natural Gas. Natural gas also is a big business in Yugoslavia. Forty-five percent of all known reserves is located in Slovenia, 50 percent in Serbia and 5 percent in Croatia. Natural gas production exceeds domestic requirements, and industries were asked in 1954 and 1955 to change from coal to gas as a source of energy.

But a shortage of line pipe as well as capital has delayed the changeover.

Pipe Lines. A project dating back to 1953 dealt with the construction of three major gas pipe lines from three major fields to nearby industrial centers:

1. From Zrenjanin in northern Serbia to the Serbian industrial center at Belgrade.

2. From Dolne-Lendava to Maribor in northern Slovenia.

3. From Gojle-Janja Lipa to Zagreb (Croatia).

Preparatory work was well under way when the project was halted by a lack of capital. The Gojle-Janja Lipa line was planned to cover 86 miles with a daily capacity of more than 31 Mmcf of gas.

A 6-inch, 124-mile pipe line was needed from Sisak refinery to the Adriatic port of Bakar with a smaller pipe line from Moslavina fields to the Sisak refinery. The latter would have to be built for an annual capacity of between 405,000 barrels and 540,000 barrels.

The Sisak-Bakar line would be important internationally since products destined for West Germany or Austria could be transported through it.

Exploration. Yugoslavia has been conducting exploration activity at an accelerated rate. Principal areas under study are:

1. Croatia: Along the Moslavina mountains, near existing fields, in the area between the Drava and Sava rivers, and from Zagreb east toward Nova Gradisca.

2. Dalmatia: Six geological field parties have been sent to check the Dalmatian coast on the Adriatic sea. Italian parties have been operating on the peninsula, which has the same geological structure as the Yugoslavian Adriatic coast.

3. Montenegro: Near the Albanian border, near Ulcinj and along the shore of Lake Skadar. A more or less definite tie-in with the producing Albanian fields has been established.

4. Serbia: About 30 miles north of Sarajevo, near Kakanj, as well as the Nish area; extending toward the south bank of the Danube river.

5. Bosnia: From Tuzla to the south bank of the Sava river.

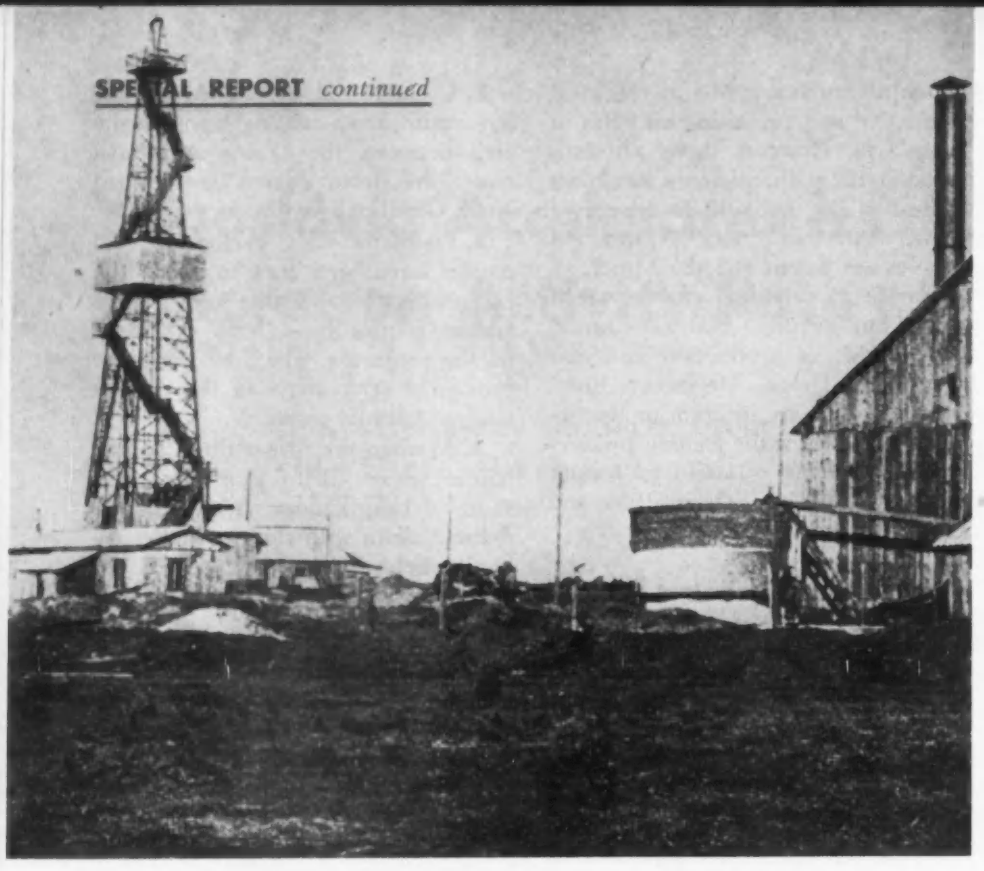
6. Slovenia: From Lendava, northeast of Zagreb to the Hungarian border. On the other side of the border, Hungary operates the Zalaergerszeg, Nagy-Kanitza and Gellenhaza fields.

New Field Discoveries. The Klostar-Ivancic field, developed and producing since 1954, was the last large field discovery. Oil reserves there have been put at 6,750,000 barrels. Smaller in area and production is the 1954/1955-discovered Maslovina mountains area. Single producing wells are located at Staro Petrovoselo and Sirmiens valley.

Another 1954/1955 discovery was in Voivodina's Jermenovice, near Velika Greda. On May 25, 1955, a well was completed with an initial flowing rate of about 200 barrels daily. It was shutin pending construction of a pipe line.

Imports and Exports. With a refining capacity exceeding the 6,750,000 barrel level during 1956 and domestic requirements resting at about 5,736,500 barrels, Yugoslavia was in the theoretical position of being able to export about 1 million barrels of products. But since utilization of the refineries will not reach 100 percent, the actual export level will be nearer 675,000 barrels, if that high. Export customers are West Germany, Switzerland, Greece, Turkey, Great Britain, and Austria.

Imports are received from Albania, Iraq, Iran, Saudi Arabia, Kuwait, Mexico, and Russia. No Rumanian crude is being imported.



Rig in Bulgaria's new oil field, which began producing in October, 1954.

Bulgaria Exploited But Not Assisted by Soviet Union

Since mid-1955, nation has been seeking foreign aid in further development of petroleum industry because Russia's price tag for such help is beyond government's ability to pay.

BULGARIA IS PROOF that Russia is playing its own game in "aiding brother nations" in the development of their resources. No better example can be found than Bulgaria's oil industry. In time of Russia's own need, its interest in Bulgaria was high. But that interest dwindled when no direct and immediate profit could be foreseen or when changes in Russia itself turned the need for assisting other countries into a burden.

Cornered by the Russian price tag on equipment and by the excessive prices asked for Rumanian products, Bulgaria fell into the typical satellite dilemma of a small nation being exploited but not aided.

Political. Bulgaria is not a sovereign state, despite having its own government, language, territory, and history. A strict Russian satellite, Bulgaria's economic concept since its "liberation" Sept. 9, 1944, has been part of the integrated Russian and Eastern bloc strategy.

The nation's 7.3 million inhabitants, living on 42,808 square miles, have been ruled by Communists since the liberation. A "Peoples' Democracy" was declared immediately after the Oct. 27, 1946, elections when 78 percent of all voters (according to poll results which may have been true or forged) favored the Peoples' Front. The monarchy was abolished Sept. 15, 1946, and the U. S. recognized Bulgaria as an independent state Oct. 1, 1947.

The Soviet Union, teaming up with the German Democratic Republic (East Germany) and Czechoslovakia, undertook to aid Bulgaria in developing what little oil industry existed during the first post-war years. Russia supplied geological equipment and experts; East Germany furnished field equipment and machinery; Czechoslovakia offered to help build two refineries.

These activities, which were reported from 1949 to 1955, were more or less halted during the middle of 1955, when Russia renounced its interest in the Bulgarian oil industry, despite modestly successfully development in exploration, drilling and production that occurred from 1952 to 1955.

Since mid-1955, Bulgaria has been searching for aid in further development of its oil industry. The price Russia asked for such aid was beyond Bulgaria's financial limits.

Drilling. The first shallow holes are believed to have been drilled during the second half of 1951. While the drilled footage and distribution of wells between the exploration, drilling and production phases are not known, Western estimates put the total number of producing wells at about 12 and the number of exploratory tests at between 8 and 12, in addition to a large number of shallow structural holes.

On Dec. 24, 1955, a Bulgarian report said: "Drilling crews under brigadier (foreman) Micho Stojanov accomplished drilling of one well in one month, ready for exploitation. He thereby handed over the ninth well in 1955."

Another report said: "While the drilling of an 804-meter (2638-foot) hole formerly took one year and six days, our advanced technique permits the drilling of an 855-meter (2805-foot) hole in just two months and 16 days."

Soviet rigs are reportedly in use with at least four BU-40 units as well as a "First of May" type rig from neighboring Rumania. Test drilling dates back to the middle of 1952 when oil industry efforts were accelerated. No drilling plans for the 1956-1960 Five-Year Plan had been announced.

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Production. Secrecy shrouds Bulgarian crude output. The only production target ever mentioned in any of the annual production goals was in 1953, when a level of approximately 67,000 barrels was mentioned. It is doubtful that this target has been reached, for at that time neither deep holes nor outright producing wells had been completed.

One news release which could not be confirmed said the 1955 crude production goal amounted to about 536,000 barrels. If that should be true, fulfillment of the plan is possible, for it was estimated that about 12 producing wells have been in operation since the spring of 1955.

The first concrete report on production came April 16, 1955, when a Sofia newspaper said: "After a night shift at the rotary rig, when 184 meters (604 feet) were drilled, a deposit was hit. Crude erupted from the well."

On July 23, 1955, another news item in the Sofia press announced: "The extraction production crews took over a new well yesterday. This well's yield is greater than all other previously yielding holes. The first dozen tons (metric tons) of crude have already been collected."

On Feb. 23, 1956, a newspaper in Stalin said: "Four strong new rigs were put into operation during 1955. The first turbine drill set (rig) was also delivered to Bulgaria to be used with a UZTM type Soviet rig. Not long ago, Bulgaria received another Soviet BU-40 drilling set (rig) from the Soviet Union."

On May 23, 1955, Well 80 started to produce and was turned over by the drilling crew to the Liquid Fuels state monopoly enterprise. Two days prior to this announcement, Radio Sofia said: "Oil is expected at drilling site R-66 at any minute. The geologist in the field is a Soviet expert; engineers, crew chief and crew are Bulgarians."

Official information is lacking as to the exact location of the Bulgarian oil fields. Well informed Central and West European sources, however, describe the petroleum area as being generally located in the triangle formed by Rogatshevo, Shable and Rosovo.

Soviet equipment, moved into Bulgaria during 1954, is capable of drilling to about 11,500 feet. The deepest well drilled in Bulgaria was drilled to 11,483 feet at an undisclosed site. These deep drilling rigs are mainly used in Burgas and Pakora, where—at the latter location—asphalt was discovered.

The first actual oil was found during irrigation work in the Tutrakhan area Aug. 20, 1952. Wells there were drilled up to 3208 feet. Tutrakhan also is part of the Dobrudga area. Tests still are under way along the Kamtshija river and near Targovishte. In the latter area, the Pakora asphalt deposits are located.

Pipe Line. Rumania plans to construct a pipe line from its Ploesti fields to an undisclosed location in Bulgaria, via Giugiu, according to a statement released April 15, 1954. No crude or products pipe lines have been built in Bulgaria yet.

Exploration. Only traces of oil were found in 1942-1943, when the Germans initiated the first exploration effort in Bulgaria. The domestic government and Russia formed the Directorate for the Search, Drilling and Extraction of Oil and Gas under the Ministry of Heavy Industry of Bulgaria during 1948. This joint organization benefited from Soviet technical know-how and equipment.

The Soviets then were eager to explore and develop all the oil their satellites might possess. Doubtlessly, the German findings were used as the basis for joint Bulgarian and Russian operations. Bulgaria financed the exploration which came to an end during the spring of last year.

One reliable Western Europe source said on June 16, 1955: "Domestic oil exploration is ended. Deputy Prime Minister Georgi Chankov, in explaining the tasks for the Second Five-Year (1953-1957) Plan's third year, stated 'the plan has no provisions for the manufacture of installations for the industrial processing of petroleum and kerosine, despite the fact that new larger layers (horizons) of crude were discovered.' He said that 'further exploration work is necessary to provide larger deposits to make production worthwhile. The start of the oil industry (probably the large-scale production of crude) depends on (a) such findings and (b) Bulgaria's financial possibilities.' Despite official speeches at the opening of new wells, exploration has practically come to a standstill."

In conclusion the source added, "Russians are said to have caused this standstill by asking too high prices for drilling equipment."

New Field Discoveries. Every field now producing or showing signs of oil has been developed since the close of World War II. The producing areas are concentrated in the Dobrudga district, but the actual field location never has been officially indicated.

Bulgaria nationalized not only its industrial, trading and transport enterprises but also its mineral deposits known at the time of nationalization (1944-1945) or discovered since then. The joint Soviet-Bulgarian oil firm working as a monopoly group under the Petroleum and Gas Directorate (within the Ministry of Heavy Industry) had no difficulty or limitation in operating where it pleased.

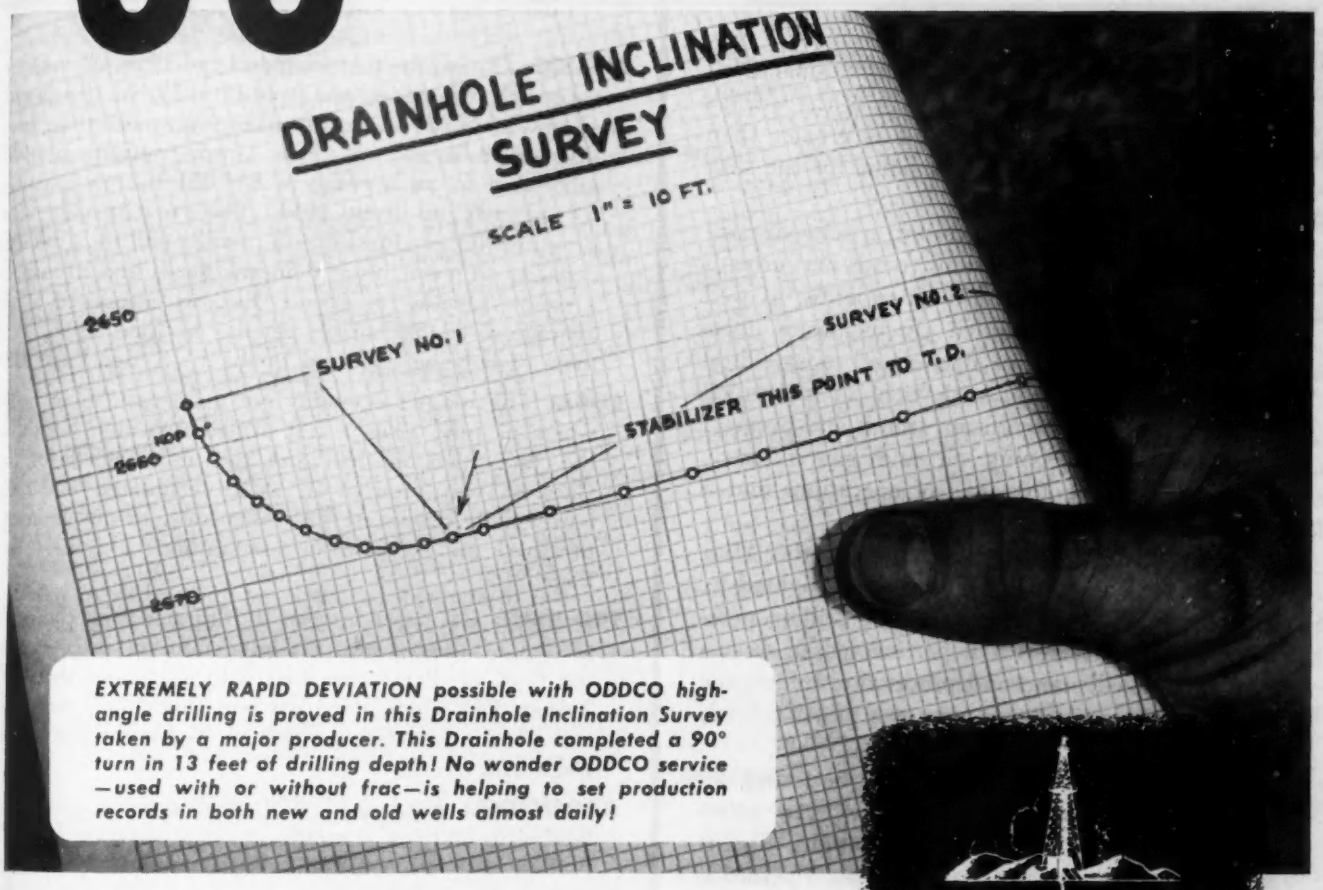
In practice, especially since the Soviets moved out of Bulgarian oil during 1955, Bulgarian oil exploration and production is being conducted according to the production plans issued by the top executive body in the country—the Council of Ministers. This is sufficient basis for the oil monopoly to disregard any legal red tape.

General Economics. Bulgaria's planned economy began Jan. 1, 1946, when the First One-Year Plan was announced. A Two-Year Plan (1947 and 1948) followed. The First Bulgarian Five-Year Plan was scheduled to last from 1949 to 1953, but was fulfilled in four years.

Consequently, the Second Bulgarian Five-Year Plan started Jan. 1, 1953, and will end Dec. 31, 1957. It is possible that a short-term plan period will be ordered after 1957 to permit full synchronization with the Soviet Seventh Five-Year Plan (1961-1965) and that of the other Soviet satellite plans which are already geared to the Soviet timetable. (Bulgaria is the only country not synchronized in plan periods with the remainder of the East Bloc countries.)

Oil Imports and Exports. Bulgaria's oil requirements, which approach 5 million barrels of crude products annually, are supplied entirely by imports. Rumania is the chief supplier, though at high prices, while Yugoslavia began in 1955 to supply Bulgaria with diesel oil—the first Yugoslav oil products shipments to a Soviet satellite country.

90° turn in 13 feet



EXTREMELY RAPID DEVIATION possible with ODDCO high-angle drilling is proved in this Drainhole Inclination Survey taken by a major producer. This Drainhole completed a 90° turn in 13 feet of drilling depth! No wonder ODDCO service—used with or without frac—is helping to set production records in both new and old wells almost daily!

DRAINHOLE DRILLING—WITH FRAC OR BY ITSELF—*MULTIPLIES PRODUCTION*

One of the surest ways to production gains is to use ODDCO high-angle drainholes. To these drainholes, controlled and directed away from the vertical bore, fracing and other treatment methods may be added for greater penetration of the main producing formation.

Instead of the ordinary 2-3 degree per 100 feet, ODDCO tools whipstock at angles of 3 to 7 degrees *per foot!* Frac and frac material is then directed *immediately* away from the bore. This reduces the possible loss of control from a single vertical hole, where frac may channel. By increasing area through drainholes, input pressures with subsequent treatments should be sharply reduced.

Where frac is impractical, drainhole drilling in itself, offers a controllable method of formation penetration. See or phone the nearest service office for "case histories" of increased recovery and well-life extension, and a helpful discussion of ODDCO service to your properties.

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What's happening around the world

THIS SPECIAL WORLD OIL International Outlook Issue, whose scope of coverage of the world's petroleum industry developments is greater than ever before, is divided at this point for the sake of convenience.

Preceding these two pages are articles discussing and evaluating the various trends and growth of the ever-expanding world oil progress, as well as exclusive and expanded discussion of facts about the oil industry of Russia and its satellites. Too, a separate section is devoted to a detailed analysis of the most significant trends and progress in Canada's burgeoning oil and gas industry, illustrated with photographs of operations and a colored map insert.

An individual section also contains the Mid-Year Outlook report on the U. S. Highlighted by an analysis of the immediate future drilling prospects, this section also will be devoted to discussions of U. S. demand and production trends, the imports situation and what the rest of 1956 holds for the U. S. oil men.

Following these two pages are to be found detailed summaries of oil operations in every other country where oil is produced or sought. And it is through these pages that domestic operators, as well as those who operate abroad, will find accounts of new oil field discoveries and other operations outside the U. S. and their effect on world operations.

This International Outlook Issue contains much information of value to the U. S. oil man, just as it does for those who operate abroad. With an increasingly significant need for keeping abreast of international oil industry developments, perceptive U. S. oil men have found that the knowledge afforded them and their personnel has a definite dollars and cents worth.

This special issue provides that information—and much more. The data published herein is made possible only through the continuing cooperation of the various governments and oil companies, as well as more than 50 correspondents outside the U. S.

On these two pages is a brief summary of significant 1955 and 1956 industry developments whose impact on the world level is—or will be—felt.

MEXICO: During the first six months of 1956, oil industry exceeded even its record pace of 1955. In this period 17 new oil fields were discovered, two more than were discovered in all of 1955. Crude output in 1955 amounted to an average of 244,821 barrels a day—6.8 percent up from 1954. The current expansion programs for production and refining call for sufficient capacity to meet future domestic needs and to furnish a sizable surplus for export. Exports amounted to an average of 80,000 barrels per day in June, 1956, with most of it being exported to the U. S. See **Page 212.**

CUBA: The island's economy got a foretaste of a boost when, in July, 1956, a test drilled two miles south of the Jatibonico oil field and two miles north of La Catalina was brought in as an estimated 800-1000 barrel daily producer. This long-awaited development presaged an increase in exploration activities. See **Page 216.**

TRINIDAD: Of major interest in Trinidad was the completion of three wells: an important oil discovery in the Gulf of Paria and two wildcats in northcentral Trinidad in which some gas was found—the first discovery of hydrocarbons in the Northern Basin. See **Page 218.**

ARGENTINA: A planned $250 million expenditure intended to increase domestic crude production from 25 million barrels to 62.8 million barrels annually within three years resulted in a blanket invitation by the government to 140 firms for required equipment. These firms which were circularized included virtually all U. S., European and Japanese equipment companies. This action represented one of the largest individual requests for private capital assistance in the oil industry's history. **See Page 224.**

BOLIVIA: Spiraling crude production, a highlight of 1955 which carried over into 1956, was the nation's focal point of interest. The increase in 1955 amounted to almost 60 percent from the previous year. **See Page 229.**

BRAZIL: To save the dollars it spends for crude oil imports, which cost $105 million annually, Brazil announced early in 1956 the largest drilling program in history combined with its single greatest exploratory effort. **See Page 234.**

CHILE: With major increases recorded in 1955 by almost every phase of its oil industry, the government this year has been considering legislation which would likely increase the tempo of oil activities by opening the country to private foreign capital operations. **See Page 236.**

COLOMBIA: Success in secondary recovery programs and continuing interest of private capital from abroad hold a spotlight in Colombia, where in 1956, oil circles' interest was focused on wildcat tests under way. See Page 239.

ECUADOR: Reportedly, a new pact will result in construction of a modern refinery to fulfill domestic requirements which amount to about 5500 barrels a day. See Page 240.

VENEZUELA: Practically all phases of Venezuelan petroleum operations reflected increases during 1955. In July, 1956, the government announced the first new concessions since 1945, just as several companies operating in the country began to detect a production decline and a lack of productive and/or prospective acreage. See Page 247.

FRANCE: Parentis oil field, a 1954 discovery, is developed into a major reserve. France's petroleum code has been clarified. Two new oil fields were discovered. Sizable refinery expansion was underway. The anticipated collective result of these developments is to reduce imports of crude and products. See Page 258.

GERMANY: Discovery of a large number of new fields and new extensions to previous fields, indicative of the significantly high operating level of the oil industry, bolstered a generally growing prosperity and was a step forward in fulfilling a greater percentage of domestic demand with domestic crude. For the past two years, German oil output has filled 31 percent of domestic demand, requiring, in 1955, importation of about 52 million barrels of mostly Middle East crude. See Page 264.

ITALY: Chamber of Deputies votes overwhelmingly for new oil code which, while it still permits limited private capital operations, has practically nationalized the country's oil business. See Page 274.

NETHERLANDS: Two oil discoveries were made in 1955 and still newer discoveries are reported. See Page 282.

ALGERIA: A better than 450 barrel-a-day oil discovery completed early this year has done much to brighten the nation's immediate petroleum industry outlook. See Page 284.

EGYPT: Thanks to an improved legal and political atmosphere for private capital operations, exploration activity has increased in tempo with rises in production, refining and pipe line operations anticipated. See Page 286.

MOROCCO: With domestic crude supplying only 7 percent of its growing demand, Morocco's interest climbed with the discoveries of new potential oil sources. See Page 291.

ANGOLA: After three years of exploration, the first southwest African oil area has been discovered on a 30,000-square-mile concession along the northwest coast. See Page 296.

IRAN: Early this year, the government asked the Consortium to increase production at an even faster rate than initially agreed upon. The Consortium said it would make every effort. See Page 302.

IRAQ: The story in this Middle East oil area was a story of continuing mounting crude production stemming from orderly development and expansion. See Page 310.

KUWAIT: This small sheikdom recorded another banner oil producing year, and regained top position of Mid-East crude producing countries which it had relinquished to its southern neighbor, Saudi Arabia, in 1954. See Page 316.

NEUTRAL ZONE: In 1955 crude production climbed 47.7 percent, well completions 30 percent and footage drilled 21.1 percent. See Page 324.

SAUDI ARABIA: Important new crude reserve reported found at Kharsaniya, 80 miles northwest of Dhahran near the Persian Gulf Shore. See Page 329.

TURKEY: Many new exploration concessions have been granted by the government to private capital companies, with a total of 141 licenses covering 17 million acres being granted or sought. See Page 352.

CHINA: Available data from Communist China indicates that the country is making a strong bid to achieve a position of importance in the world's petroleum status. Potentialities for fulfilling this goal are believed to exist in the country. See Page 381.

PAKISTAN: The first half of 1956, as well as the entire year of 1955, was a bright period for Pakistan in the phase of exploration. Importance of this trend stems from the fact that domestic crude furnishes but 20 percent of domestic requirements. See Page 382.

PHILIPPINES: Projected operations of oil companies currently holding exploration concessions on the islands was expected to heighten interest during 1956 as a proposal was introduced in the Congress of the Republic in an effort to amend the Petroleum Act of 1949. See Page 386.

AUSTRALIA: Following a year of an intensified exploration program, the country looked forward to continuing high level of operations. See Page 390.

TAIWAN: Small crude production is found on a previously untested structure as the new exploration program reached the drilling stage. See Page 400.

BURMA: A refinery is being constructed at Syriam, near Rangoon, will replace but not equal the pre-war plant which was destroyed during World War II hostilities. See Page 362.

INDIA: Increasing crude production, continuing drilling and an unflagging interest in exploration operations drew the spotlight in India during 1955 and early 1956. See Page 362.

JAPAN: A successful wildcat test was drilled at Daihango in the southern part of Akita Prefecture which initially produced at a rate of 7 barrels daily. Preparations were under way for the drilling of a deeper test than the new discovery—a producer at 1640 feet. See Page 366.

INDONESIA and British Borneo: Crude production rose steadily last year as the private companies operating throughout the region sought to repair, develop and extend producing fields damaged during World War II. Only Western New Guinea suffered any decline in oil production. The Indonesian Government has established its own petroleum bureau. See Page 374.

Alaska . . . Active exploration program continues. Colorado Oil and Gas receives contract.

THOUGH NO OIL was discovered in Alaska during 1955, exploration activity increased. This phase of operations, as well as approval of contracts for even more, continued into 1956.

Phillips Petroleum Company reportedly planned in 1956 to drill its third test in Alaska, just south of its second well. Nine additional wildcats are scheduled under contract terms within 10 years. The company's first well was a stratigraphic test abandoned as a dry hole at 4837 feet in 1954, and its second test in its Katalla-Yakataga district block was drilled to 10,013 feet in 1955 as a dry hole although oil sands were found.

Other activities in 1955 included:

1. Havenstrite Oil Company test on Iniskin peninsula, which was suspended at 9745 feet because of winter weather. The well was scheduled to continue drilling during 1956.

2. Anchorage Gas and Oil Company test north of Anchorage, which was drilled to 2100 feet.

3. Alaska Gulf Oil & Gas Company test, located south of the Anchorage Gas & Oil Company test, was drilled to 3855 feet and abandoned.

4. Aledo Oil Company of Fort Worth, Texas, and the Alaska Oil and Gas Development Company of Anchorage drilled to 3060 feet the first of two scheduled tests.

One of the latest firms to get acreage in Alaska was the Colorado Oil and Gas Corporation of Denver. The Interior department in May, 1956, approved an exploration contract for oil and gas on 1.2 million acres in the Icy Bay-Cape Fairweather area of southern Alaska. The 10-year pact calls for expenditures by the company of at least $1 million for exploratory work by April 1, 1961. The area involved lies southeast of the Katella-Yakatagka section in which Phillips Petroleum has 1,063,884 acres resulting from a 1953 contract.

Approval of the new contract concluded a three-year effort by Yakutat Development Company to open the area to exploration.

Other leaseholders in Alaska include Standard Oil Company of California, which spent approximately $150,000 in exploration in 1955; Shell Oil Company, which reported four geophysical crews in operations in Kenai and Alaska peninsulas last year; Richfield Oil Corporation; Ohio Oil Company; Union Oil Company of California, and Sunray Mid-Continent Oil Company.

Naval Reserve No. 4. One gas well, drilled by the U. S. Air Force, was the only well completed last year on Naval Petroleum Reserve No. 4 in northern Alaska. Total footage drilled amounted to 2456 feet. No oil wells were producing at year's end, and only two gas wells were producing. Crude reserve estimates as of Mid-Year 1956 were put at 500,000 barrels.

Natural gas reserves were estimated at between 231.7 and 233.7 billion cubic feet (see Table 1). Gas production last year was 114,950,000 cubic feet from South Barrow field.

TABLE 1

Gas Field	Estimated Proved Reserves (in billion cubic feet)
South Barrow	5 (to 7)
Gubic	222
Uniat	4.7
Total	231.7 (to 232.7)

Mexico . . . First half of 1956 outdistances record 1955 pace. 17 new fields discovered.

MEXICO'S OIL INDUSTRY during the first six months of 1956 was exceeding even its record pace of 1955. While last year was regarded as one of the most important in the history of Petroleos Mexicanos, the government oil agency, 1956 was bidding fair to overshadow it.

Proof lay in the nation's new-field discovery rate. In the first half of 1956, 17 new oil fields were discovered, 2 more than were found in all of 1955. And the most promising of the 1956 discoveries was completed June 17 in the San Andres field, about 31 miles southeast of Poza Rica field. Initial production of the San Andres discovery was 2520 barrels of 20.6 gravity crude from Checontepec sands of the Lower Eocene age at 9350 feet.

Of this discovery well, Antonio J. Bermudez, director general, Pemex, in June said: "This is the most productive well to be completed in 1956—and it is not a part of the New Golden Lane fields. We have every reason to believe this is a new major field. However, we will soon have four more rigs in the field and they should tell the complete story."

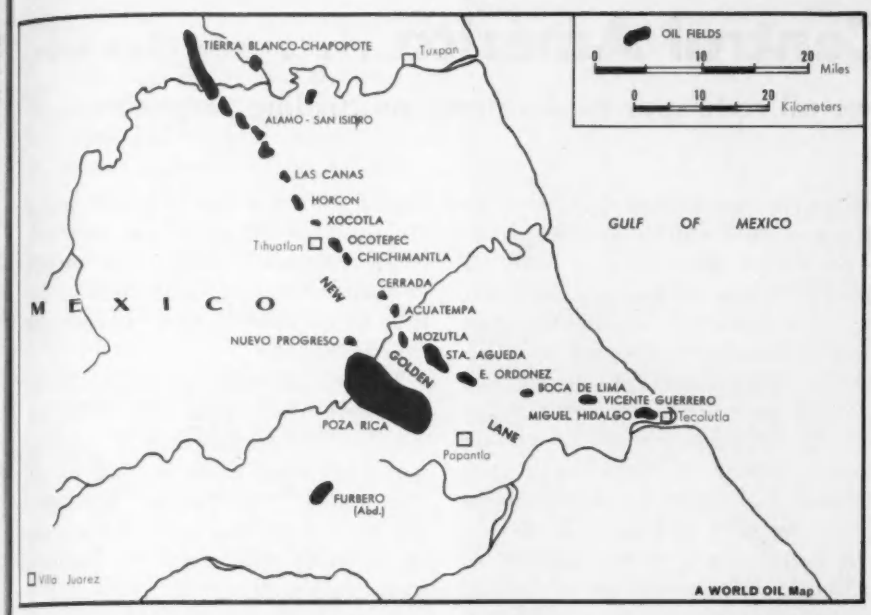
The 1956 operational pace was abetted further by these developments during the first six months:

- The drilling of 181 wells—110 of which were producers.
- The operation of 124 drilling and workover rigs, with an additional 34 expected to be in the field by year's end.

Demand. Mexico's demand for light products has increased from 7½ percent to 10 percent annually since 1951; however, the demand for residual products has not risen appreciably during the past five years. Consumption during the next five years is expected to keep pace with the past five years, possibly showing a greater increase.

Pemex's current expansion programs call for sufficient crude production and refining capacity to handle all future domestic needs and to result in a sizable surplus remaining for export. The company's goal for production was 500,000 barrels of oil a day, as compared to the mid-1956 daily average of about 270,000 barrels. Exports amounted to an average of 80,000 barrels daily in June, 1956, with the majority being exported to the U. S.

1955 Production. Mexico's crude yield last year amounted to a daily average of 244,821 barrels—89,359,659 barrels for the year—which reflected a 6.8 percent increase from 1954. In that year, a daily average



MEXICO . . . Poza Rica and New Golden Lane oil fields produced an average of 180,490 barrels a day in 1955.

yield of 229,139 barrels amounted to 83,636,399 barrels for the year. Pemex produced most of the nation's oil, with but 3374 barrels daily stemming from independent company operations.

1955 Drilling. Pemex drilled 330 wells during 1955 for total footage of 1,789,805 feet. That amounted to an increase in the number of wells completed of 12.6 percent from the previous year, when 293 completions were recorded.

Of the 330 wells, 176 development efforts and 12 wildcat tests resulted in oil discoveries totaling 188 for the year, 14 more than for 1954. Thirty-two field wells and 4 tests found natural gas, as compared to 19 gas well completions for the previous year, and dry holes totaled 106. An even 100 dry holes were completed in 1954.

At year's end, 1513 wells were producing oil, and 41 were gas producers. Fifty-eight wells were being drilled at the same period.

Proved crude reserves, as of mid-1956 were put at 2.5 billion barrels of oil, 73,935,365 barrels of distillate, and 5,234,158 Mmcf. of natural gas.

With eight operating refineries last year, Mexico's daily average crude runs to stills amounted to 220,547 barrels. Total daily crude charging capacity was 296,500 barrels daily.

Natural gas production during 1955 amounted to 119,791,457,920 cubic feet (see Table 1.).

TABLE 1
1955 Natural Gas Production in Mexico (in cubic feet)

District	Amount
Northeastern	26,386,777,748
Poza Rica	
Poza Rica	71,507,391,881
M. A. Camacho	47,521,210
Cerro Azul	15,141,273,420
Isthmus	6,390,068,917
Central Zone	
Veracruz Central	318,424,807
Total	119,791,457,920

1956 Plans. Pemex planning operations early in 1956 included the following developments scheduled for completion by year's end:

1. Additional cracking plant installations at Atzcapotzalco.

2. Expansion of gas collecting facilities in Poza Rica to develop recently-discovered gas fields.

3. A gas absorption plant at Ciudad Pemex, Tabasco.

4. Modernization of the Ciudad Madero refinery in Tampico, including installation of a cracking plant.

5. A cracking plant in Salamanca.

6. Expansion of lubricants production at Salamanca.

7. Modernization and expansion of production at Poza Rica.

8. The drilling of an estimated 1,920,320 feet of hole.

Other major new-field discoveries reported by Pemex included Tamaulipas field 25 miles north of Tampico and the Gutierrez Zamora field, near Papantla, Veracruz. In February, 1956, Pemex announced that Tamaulipas 1, the field discovery well, was producing 1500 barrels of high grade crude daily. Quality of Tamaulipas crude was compared favorably with

Drilling in Mexico

All by Petroleos Mexicanos, Government Agency

DISTRICT	Wells Completed in 1955								Wells Completed in 1954			
	Development Wells			Wildcats			Total					
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage	Oil	Gas	Dry	Total
Poza Rica:												
Poza Rica	37	0	2	3	0	0	42	347,592	71	0	23	94
New Golden Lane	47	2	14	5	0	7	75	408,134	..	..	..	..*
Frontera	3	23	9	1	2	7	45	326,308	18	16	10	44
Tampico:												
North	1	0	3	0	0	7	11	36,654	3	0	8	11
South	5	1	5	1	1	11	24	86,639	..	..	..	..†
Central Zone	14	0	3	1	0	17	35	154,443	14	0	29	43
Southern Zone	69	6	12	1	1	9	98	430,035	59	3	17	79
Others	0	0	0	0	0	0	0	.....	9	0	13	22
Total	176	32	48	12	4	58	330	1,789,805	174	19	100	293

* New Golden Lane 1954 completions included in Poza Rica total.
† South Tampico 1954 completions included in Northern District total.

Oil Production in Mexico

DISTRICT	Daily Average in 1955	Year, 1955	Daily Average in 1954	Year, 1954
Poza Rica:				
Poza Rica	109,483	39,961,238	165,733*	60,493,031
New Golden Lane	71,007	25,917,486	.....*	.....*
Tampico:				
North	13,393	4,888,343	18,279†	6,672,010
South	15,935	5,816,438	.....†	.....†
Central Zone	6,658	2,430,292	18,080	6,599,211
Frontera	3,749	1,368,528	5,029	1,835,548
Southern Zone:				
Isthmus and Tabasco	21,222	7,745,984	20,613	7,523,700
Others	3,374	1,231,350	1,405	512,899
Total	244,821	89,359,659	229,139	83,636,399

* New Golden Lane 1954 production included in Poza Rica totals.
† South Tampico 1954 production included in Northern District total.

that of Naranjos, Veracruz—the top rated crude of Mexico. Three rigs were ordered to Tamaulipas, and intensive drilling was planned.

In mid-1956 new gas-producing areas in the north were discovered—Guillermo Prieto field in Tamaulipas and Culebra and Azucar fields, west of Reynosa. Each of the three gas fields was producing more than a million cubic feet of gas daily.

Exploration. Pemex last year conducted exploration activities in 13 states. Twenty-five geological parties, 17 seismograph and 5 gravimeter crews carried out field operations in Chihuahua, Coahuila, Nuevo Leon, Tamaulipas, San Luis Potosi, Veracruz, Puebla, Oaxaca, Tabasco, Campeche, Yucatan, Chiapas, and Southern Lower California.

By mid-1956, nine wells had been drilled in Lower California. While only small showings of natural gas have been discovered, exploration drilling was scheduled to be continued on the west coast.

Pipe Lines. To improve the nation's internal refined products distribution, the following pipe lines have been built:

- A pipe line from Poza Rica field to the Mexico City refinery which permits the delivery of 115,000 barrels daily of crude.
- Gas line from Poza Rica field to Mexico City.
- Doubling of the capacity of the oil pipe line between Minatitlan and Salina Cruz.
- The two lines under construction in mid-1956—products line from Tampico to Monterrey (330 miles) and the oil line from Angostura field to Veracruz—were expected to be completed within several months.

Imports. Mexico imported 15.1 million barrels of refined products during 1955, and Pemex absorbed the loss between cost of the imports and the retail price at which they were sold in Mexico—a subsidy to assist local industry and agriculture.

Reason for most of the imports was that large areas of Mexico cannot be furnished with domestically refined products economically because of transportation difficulties. This type of imports amounted last year to 4.6 percent of total consumption.

Central America . . . New discoveries, new oil code spur exploration and drilling programs.

EXPLORATION EFFORTS and drilling programs in Central America have continued to increase. The result of this expanding program throughout the area has been to step-up even further reconnaissance efforts. Increasing the interest in Central America have been factors ranging from the improved climate for private capital operations, as in Guatemala, to the actual discovery of new oil, as in the Barbados and Costa Rica.

A country-by-country summary of 1955 and 1956 operations in Central America follows.

Guatemala. No drilling occurred in Guatemala in 1955 due to lack of legal authority to allow it. However, lengthy strides were made during the year in this direction.

The new government, headed by President Carlos Castillo, having overthrown the leftist Jacobo Guzman regime in 1953, issued a new petroleum law, effective Aug. 8, 1955. This code rescinded a 1949 law that was designed by the prior regime to make untenable any private capital exploration for and development of any oil that Guatemala may have. The 1955 code included the 50-50 principle of profit-sharing between the government and any oil concessionaire who profits from oil operations in the country.

The initial filing period for concession applications closed Nov. 23, and 29 groups filed 91 exploration permit applications by the deadline. Included were a number of U. S. independents; Archer Oil Company, Halbert and Jennings, Signal Oil Company, Bandini Petroleum, among others, and such major companies as Union Oil Company of California, Standard of Ohio, Esso Standard, Texas Petroleum, Sun Oil, Amerada Petroleum, and Atlantic Refining Company, etc. Several Guatemalan and other Central American groups also filed applications.

The rugged and remote northern part of the country is the most prospective. As each applicant may request up to 988,400 acres, there are many overlaps which are difficult to resolve since the area is poorly known and sketchily surveyed. At least four major companies have done surface geological work in Guatemala at one time or another, so there is incentive for bargaining.

The Guatemalan government had extended until April 19, 1956, the deadline for resolution of all conflicts, and had hoped to have them all settled, either by outside agreement among companies with overlapping claims or by government intervention, by the end of May.

Exploration was expected to progress slowly, for the additional reason that the border between Guatemala and British Honduras is not well defined, and the complicated overlapping claims of applicant oil companies may be further involved in boundary questions between Guatemala and the British. This being the case, oil equipment may all have to be brought into one small Caribbean port at Livingston on Amatique Bay.

Jamaica. Active exploration continued during 1955 and 1956 on the Island of Jamaica. Last year, Base Metals Mining Corporation of Toronto, Canada, drilled a wildcat to 6314 feet in Upper Cretaceous, which, though dry, had encouraging shows and indicated a favorable geologic section. The location was at Negril Spots, in the western part of the island.

Since then, Jamaican Stanolind Oil Company has acquired exploratory rights on 5.5 million acres, including the entire Island of Jamaica and the submerged lands to an average of 12 miles offshore.

Stanolind had four surface geological, one core drill, and one seismograph, parties contracted for Jamaica work. On June 3, 1956, Jamaican Stanolind spudded its first test on Santa Cruz Mountain, five miles south of Malvern. The wellsite is 2650 feet above sea level and located 45 miles southeast of the Negril Spots dry hole. Appropriation for Stanolind's work was $2 million. Associated Noble Corporation of Tulsa is the drilling contractor at Santa Cruz.

Haiti. In 1956, Mark Edwin Andrews of Houston, Texas, was reported drilling ahead on the second test on the Island of Gonave at 7000 feet. Gonave is located just west of the mainland of Haiti, the Island of Hispaniola.

Commonwealth Oil Company of Houston originally acquired 50-year concessions on the 180,000-acre Island of Gonave and on 120,000 acres on the mainland to the northeast. Andrews later took over the concessions, Commonwealth retaining the right to earn one-third interest when and if Andrews recovers his expenditures out of production. John W. Mecom of Houston had acquired one-half interest in Andrews' venture. R. L. Kirkwood, of San Antonio, Texas, is the contractor.

Andrews completed the deal April 14, 1955, assembled 1000 tons of equipment on a barge and LSI at Houston, sailed on May 10, and completed unloading at Gonave beach by May 26. The first test, 14 miles from the beach, was spudded during the summer of 1955, and though projected to 6500 feet, ran into mechanical troubles short of the target.

A thick Tertiary and Cretaceous section was indicated by surface geology on Gonave, which is essentially an anticline sticking out of the Caribbean Sea. Nearest current production is in Cuba, 300 miles west of Gonave.

Barbados. During 1955, Barbados Gulf Oil Company abandoned its third test on March 24, after running 5½-inch casing to 5547 feet to test prospective horizons indicated by electric log. Total depth of the failure was 5596 feet.

A fourth test, Spring Vale 1, near the center of the island, was spudded in April 25. After reaching 12,178 feet by the year's end, 5½-inch casing was landed at 10,330 feet and the well was being tested. Later, in early 1956, Gulf announced a gas-distillate discovery.

Though there is one small gas distributor at Bridgetown, the market is limited and probably would remain so even if large gas reserves, not yet proven, were developed. Gulf is looking for oil and would very likely sell any gas production to local interests.

Tertiary sediments, badly faulted, with formation dips commonly in the order of seventy and eighty degrees, were being explored.

Costa Rica. Union Oil Company of California was drilling its fourth test on a 3 million acre exploratory concession in eastern Costa Rica in mid-1956. After three failures, Cocoles 1, the latest drilling location, found high gravity oil in a thick sandstone at 5400 feet and another possible pay zone at 6400 feet. Cocoles number 1 was being deepened to evaluate the location fully. A second test was scheduled to be drilled on the same structure in an attempt to develop the oil found thus far. Loffland Brothers is the drilling contractor.

A thick Tertiary section has been proven in the area. The company's Province of Limon 1, abandoned in 1955, was drilled to 10,128 feet in Oligocene beds.

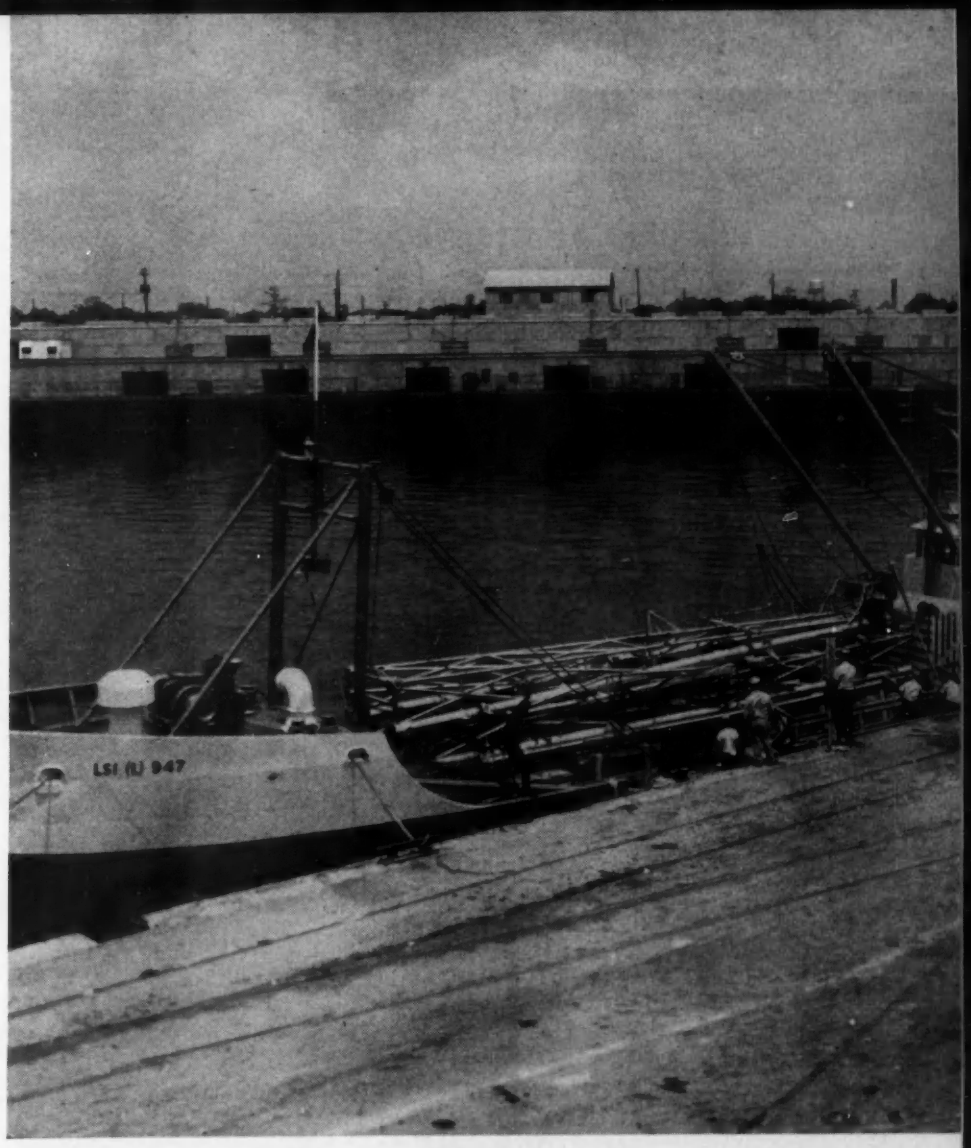
Union Oil holds a large concession in Panama on the same trend, contiguous with its Costa Rica holdings. However, the International border may not be satisfactorily defined as yet.

Honduras. Last year, Compania Petrolera Hondurena, formed by the late John L. Sullivan, of Sullivan and Garnett, Corpus Christi, Texas, had a 48-million acre concession along the northern coast. The permit, governing search for oil, gas, coal, iron, sulphur, and manganese, was for 20 years.

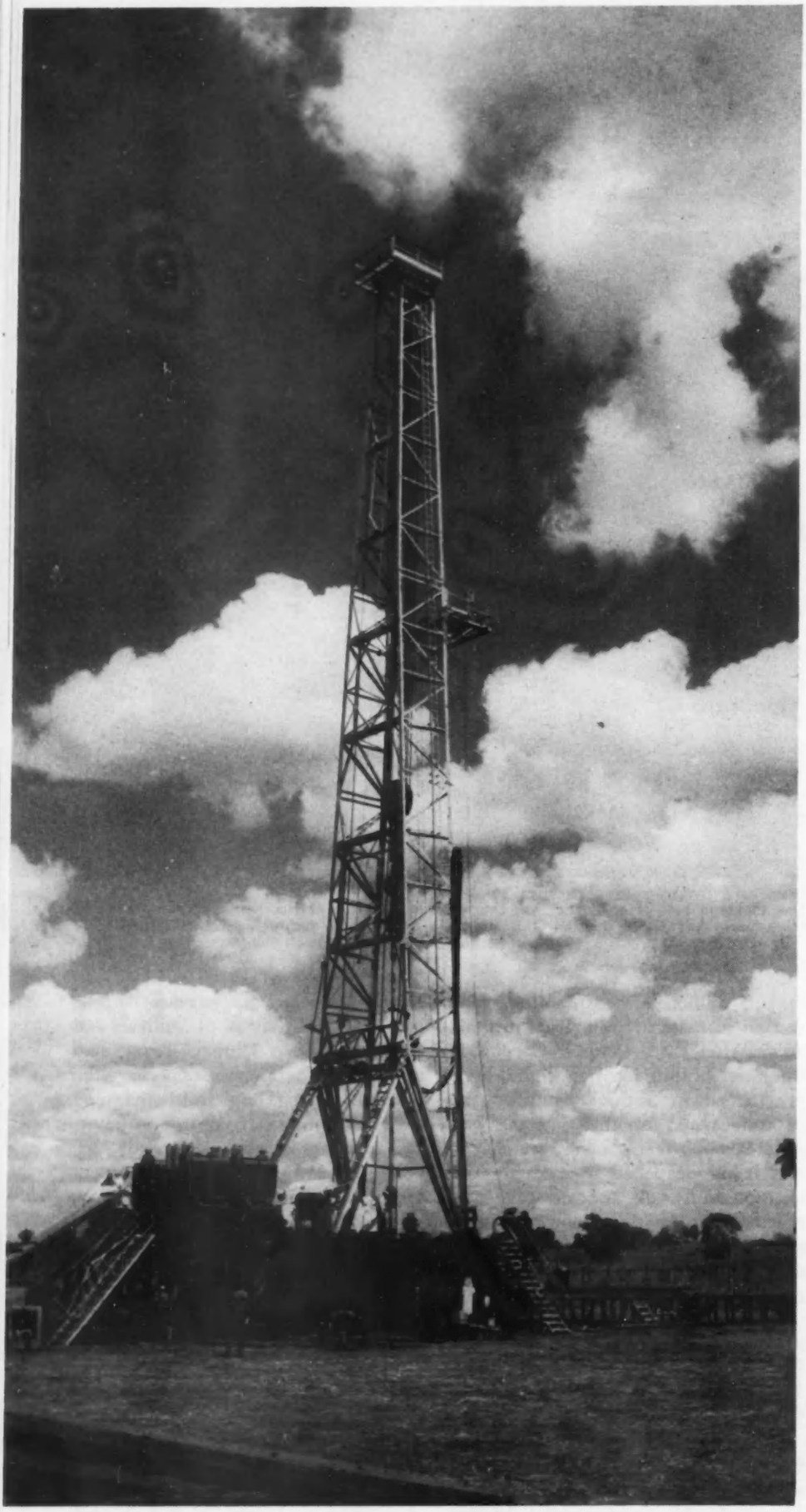
During 1955, John W. Mecom of Houston, acquired the concession, with CPH retaining 15 percent of the acreage. Drilling operations were in progress in mid-1956.

British Honduras. British Honduras Gulf Oil Company continued exploration during 1955 and 1956. Its first test, Yalbac 1, was drilled at a location near the Guatemala border, 48 miles west and slightly south of Belize.

Drilling contractor is Santa Fe Overseas Drilling Company. Yalbac 1 was spudded June 20, 1955, and by the end of the year had reached 6633 feet. It was abandoned, and the rig moved to another location.



One thousand tons of equipment was shipped from the Port of Houston to Gonave beach by Mark Edwin Andrews of Houston. This is drilling mast for the test well which was spudded in July 4, 1955, on the island of Gonave, west of Haiti.



C. J. Simpson Drilling Company of Cuba rig drills Vega Grande 1 for Cuban American Drilling and Exploration Company in Las Villas province. It is one of the largest rigs ever brought to Cuba.

Cuba . . .

HOPES THAT Cuba, in 1955, would take a major step toward reaching petroleum independence were fulfilled. Blossoming under the stimulating influence of a welcoming political atmosphere, private enterprise—in one year—has boosted Cuba's crude production 567.8 percent. And the outlook for the island is almost as optimistic as its immediate past.

Included in this favorable outlook was the initial appraisal of a well brought in by Cuban American Drilling Company in Camaguey Province which was estimated as an 800-1000 barrel daily producer. The well, drilled with a rig contracted from C. J. Simpson Drilling Company of Cuba, reached a total depth of 7157 feet. (See WORLD OIL, August 1, 1956, Page 161).

This discovery well, Catalina 1, was spudded in May 30 about two miles from Jatibonico, Cuba's principal producing area. This field, discovered May 1, 1954, produced an average of 1222 barrels of oil a day through the first three months of 1956. Up to May 15, 1956, only five wells had been drilled this year in Jatibonico, and production had tended to level off.

Politically, no changes occurred in Cuba during the past year. Decree No. 1526 of July, 1954, remains the most recent change. But as yet no interpretation has been released on the paragraph of that decree which freed large areas held in the government reserve for years.

Failure to interpret this paragraph was continuing to delay development of certain areas. The government, however, is encouraging exploration for oil by capital from abroad as well as domestic capital, and the oil man from abroad will find government officials cooperative and regulations favorable in Cuba.

Drilling up. Footage drilled last year represented a new high for Cuba as a steady growth in activity continued throughout the year. Seven rotary rigs were active as of Jan. 1, 1955, and 12 were in operation at year's end. On

Private enterprise catapults crude production 568 percent.

April 15, 1956, the number had risen to 13. Fifteen cable tool rigs were in operation on Jan. 1, 1955, and 12 at year's end. But by April 15, 1956, 13 were active, and a fourteenth was engaged in well completion work.

This year, however, was expected to record about 500,000 feet of hole—about twice the 1955 total of 249,831 feet. While some core drilling was reported last year, it is expected that core drilling footage would rise to several thousand feet.

Production Soars. In contrast to 1954 crude output of 57,173 barrels —slightly more than an average of 156 barrels per day—Cuba produced last year 381,824 barrels, or almost 1046 barrels per day. Jatibonico field alone boosted its production from 10,000 barrels for 1954 to 299,360 barrels last year. Jarahueca field climbed from 39,107 barrels to 54,-800 barrels. Motembo field production skidded from 6566 barrels in 1954 to 6235 barrels last year. Bacuranao producing area climbed from 1500 barrels to 21,429 barrels.

At the end of 1955, 39 wells were producing oil, and about 125 stringer wells in Motembo were producing a total of about 17 barrels of naphtha daily. Most of these stringer wells are bailed weekly or monthly.

One well was shut in at year's end. It was the Jones-Thomas Bess 2, which was awaiting a market. Storage facilities were inadequate to permit production. Twenty wells were drilling at the close of the year.

• **Bacuranao production** includes that from the Cruz Verde field and from the Ted Jones well at Santa Maria del Mar. Both Cruz Verde and Santa Maria del Mar are located near Bucuranao; however, in the accompanying production table, the figures are reported under "Havana" inasmuch as almost all the production stems from Cruz Verde and Santa Maria del Mar fields and no production of any extent was obtained from the old Bacuranao wells.

• **Jatibonico production** rose to a new high of 1269 barrels daily in February, 1956. On Jan. 1, 1955, the field was producing only 400 barrels daily. This output rose to 800 barrels a day in May, 1955, and to 1200 barrels daily in October. In March, 1956, the field experienced a slight decline.

• **Jarahueca production** showed a slight fluctuation during 1955, rising from 110 barrels daily in January to 200 barrels in April and down to 120 barrels daily in August. In November, daily output rose to 150 barrels where it remained through March, 1956, when it dropped to 136 barrels daily. Production from the Motembo naphtha stringer wells averaged a relatively stable 17 barrels a day during 1955, except for one month when the average rose by a single barrel.

• **Havana production showed** a slight increase, with Cruz Verde field rising from a daily average of 40 barrels in January to 92 barrels in December. When the Jones well at Santa Maria del Mar went into full production, this figure rose to 220 barrels per day in March, 1956.

It appeared at mid-1956 that little additional drilling would be done in Jatibonico field during the remainder of this year. Although Cuban Kewanee Oil Company planned to do more drilling there, Jarahueca field was relegated temporarily to a relatively secondary position in the island's drilling program. It was indicated that Reiter-Foster Oil Company possibly would do some drilling there this year.

Further indications at mid-1956 included these:

• Drilling activity at Motembo field was expected to continue at the

CUBA . . . The Catalina discovery well, near Jatibonico field, has accelerated exploration interest on the island.

same level of operations—with six to eight cable tool rigs engaged in shallow drilling. Production was expected to remain relatively stable.

• Drilling in Havana area by Cuban Kewanee on the Jones' leases was expected to increase production there, perhaps considerably.

• Moderate crude output increases were seen as possible in the Cruz Verde region as more shallow holes were completed.

At mid-1956 it appeared that the Jones field at Santa Maria del Mar offered the only real promise of a considerable production rise during the year, inasmuch as the drilling spotlight was moving away from other fields.

In fact, *Cuba Petroleum News Digest* indicated that any increase in crude production would depend on new wells in the Jones leases and/or new productive areas discovered by wildcats.

Exploration activity experienced a steady rise last year. At the beginning of 1955, two companies each had a single crew in the field in Camaguey province. At year's end, several more crews were in the field and in March, 1956, eight crews were at work.

It was expected that during 1956 the number would increase to about 15 crews, with 12 on land and 3 marine, doing geophysical work. Most of the work thus far has been seismic, although magnetometer and gravity meter surveys also were being run.

The possibility of a new-field discovery in Cuba during 1956 was considered more likely than during the previous year. The reason was that a large portion of the 1955 drilling was conducted in known fields, whereas in 1956 the emphasis was moving into previously unexplored areas.

Practically the entire island has been brought under concession under terms of the Mineral Fuels Law of 1938. Release of government-held reserves in July, 1954, caused a flurry of claims throughout Cuba, but since the latter part of 1954 the number of requests being filed has declined. Some requests still are being made, but in most cases these overlay concessions in good standing.

In recent months there has been a trend for concessions to become concentrated in the hands of major companies. But sizable parts of the island remain under control of small firms and independent operators. Those interested in entering Cuba will be more or less forced to deal with lessors or concession holders.

Large areas are available throughout the island at reasonable royalties and with normal drilling obligations. It is likely that there will be increased trading in concessions and leases during 1956, and that new areas will be developed at an accelerated rate.

An adequate supply of labor for work in oil fields and related industries is available in Cuba. The number of nationals receiving training in the operation of rotary rigs is increasing, and some crews now are run entirely by Cubans under the supervision of a U. S. toolpusher.

Housing is not a problem in most sections, owing to the mild climate. The island is slender, and most drilling operations undertaken have been located near a town with suitable accommodations.

Cuba Oil Production

FIELD	1955 (in Barrels)	1954 (in Barrels)	Province	Type
Jatibonico...	299,360	10,000	Camaguey	Crude
Motembo...	6,235	6,566	Las Villas	Natural Naphtha
Havana*....	21,429	1,500	Havana	Crude
Jarahueca...	54,800	39,107	Las Villas	Crude
Total...	381,824	57,173	.....	.....

* Formerly Bacuranao. Cuba Petroleum News Digest reports change in field name is more correct since Havana field includes Bacuranao production as well as production from Cruz Verde and Santa Maria del Mar.

Drilling in Cuba

FIELD	1955 Well Completions			
	Oil	Gas	Dry	Total
Jatibonico.....	18	..	22	40
Motembo.....	18	..	19	37
Havana*.....	7	..	5	12
Jarahueca.....	1	..	5**	6
Total.....	44	..	51	95

* Formerly Bacuranao.
** After being treated, wells still had not recovered treatment oil.

The economy of Cuba continues to be tied closely to sugar and the world price of that commodity. Local sugar crops have been restricted somewhat in recent years as a result of overproduction. Consequently, there has been some unemployment. The current sugar bill was being considered in the U. S. Congress, but the bill reported from committees gave Cuba a slight increase over the quota for last year.

The country is economically stable. Credit is good, and payments generally are made within terms. Sizable public works are in progress, and it is likely that these will serve to improve the country's general economy. The government is trying through all available methods to reduce the country's dependence on sugar, and progress in that direction is being made.

Trinidad . . . New discovery in Gulf of Paria highlights 1955.

While the distribution of leases changed little in Trinidad during 1955 and exploration activity continued on the same scale as in the previous year, an important discovery was made. Trinidad Northern Areas, Ltd's, HS-1, since renamed Soldado 1, was brought in with an initial producing rate of 160 barrels a day. It was the company's first marine well and is located in the Gulf of Paria six miles north of the Cedros peninsula.

Soldado 1, whose site was determined by seismic, gravity meter and geological surveys, was completed in March at 7500 feet in the Cruse (Miocene) formation. Thirty-four gravity crude is produced from the 4400-4800-foot interval. The new field is called High Seas.

In two exploratory tests drilled in north central Trinidad, some gas was found—the first discovery of hydrocarbons in the Northern Basin.

Operational developments during the past year included the introduction of a drilling barge by one company to develop its offshore field while U. S. drilling contractors were scheduled to be brought to the island for land drilling. No major construction activity occurred during 1955.

Total crude production for Trinidad last year established a record in this phase of the industry for the third successive year, with a 5.5 percent increase from 1954. Output in 1955 was 24,895,805 barrels, or 68,208 barrels per day, as compared with 23,629,329

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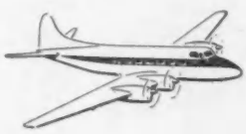

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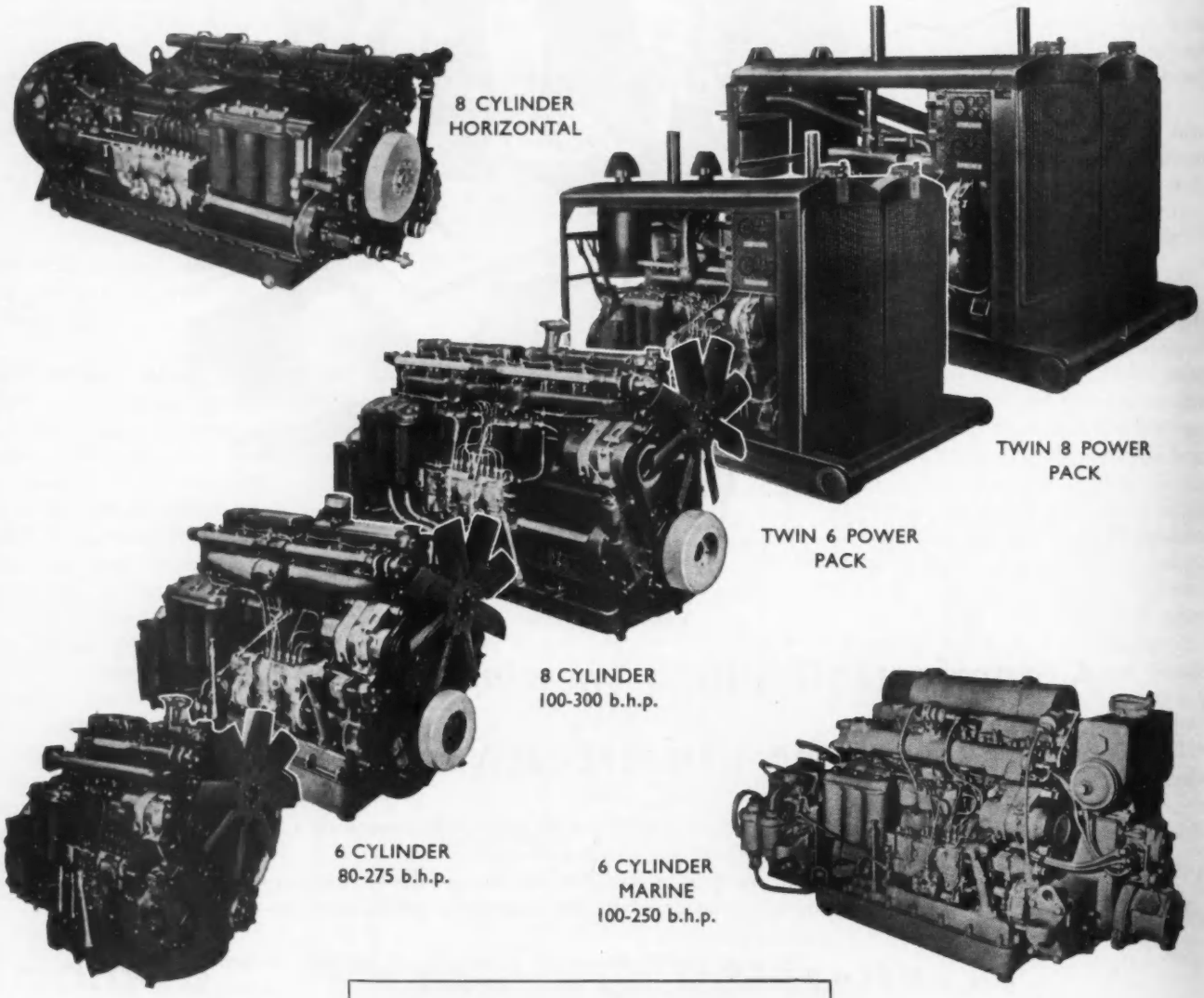

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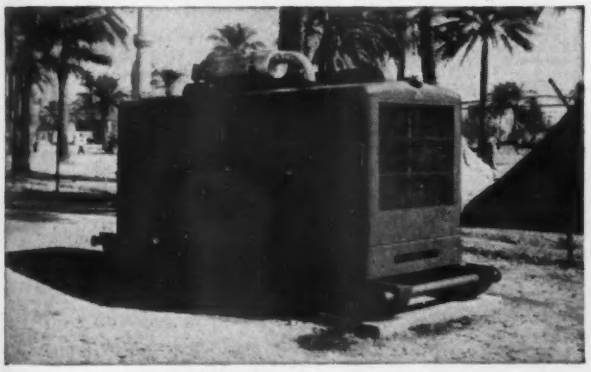

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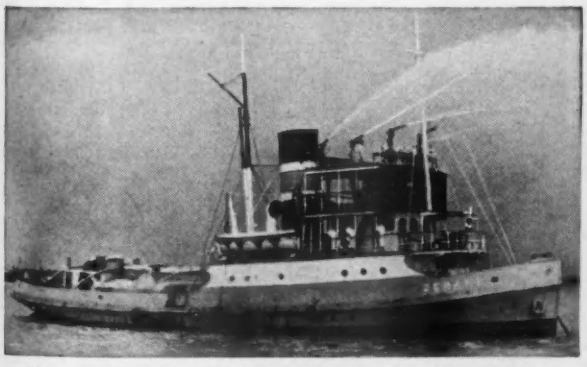
Scammell Constructor in Kuwait



Merryweather Fire Fighting Equipment in Indian Ocean

V.R.180 Tractor in Tasmania

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OIL ENGINES

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TRINIDAD . . . Offshore test produces 160 barrels daily.

barrels, or 64,737 barrels daily, during 1954.

Total cumulative crude production as of December 31, 1955, according to the Petroleum Association of Trinidad, was 527 million barrels while the natural gas cumulative figure was an estimated 797,500 Mmcf. Last year, 10 producing companies accounted for a natural gas yield of 40,772 Mmcf.

During the year, 2780 wells were producing, and 1717 wells were shut in as of December 31, 1955. Twenty-three wells were drilling at year's end.

Footage Drilled. Trinidad's 228 wells completed in 1955 accounted for total footage drilled of 987,567 feet. That is equivalent to an average depth of 4413 feet per well. In 1954, 202 completions were reported along with a footage drilled figure of 911,242 feet—or an average of 4511 feet per well.

Trinidad's three refineries, located at Pointe-a-Pierre, Point Fortin and Brighton, accounted for a total average daily throughput of 110,000 barrels. Total capacity of the three plants is 122,000 barrels daily.

Oil Production in Trinidad

COMPANY	CRUDE OIL PRODUCTION (Barrels) Year 1955	Year 1954	Cumulative Through 1955	Natural Gas Production During 1955 (in Mmcf)
Antilles Petroleum Company, Ltd.	1,298,637	1,275,595	13,121,178	2,201
Apex (Trinidad) Oilfields, Ltd.	3,005,101	3,022,389	105,208,567	3,931
Dominion Oil, Ltd.	.....	.....	n.a.	....
Kern Trinidad Oilfields, Ltd.	964,799	983,184	19,310,543	456
Premier Consolidated Oilfields, Ltd.	365,615	367,697	n.a.	33
Siparia Trinidad Oilfields, Ltd.	826,792	522,839	n.a.	880
Trinidad Leaseholds, Ltd.	6,464,290	6,524,125	188,213,154	10,710
Trinidad Northern Areas, Ltd.	438,703	133,645	572,348	523
Trinidad Central Oilfields, Ltd.	1,465,134	1,602,670	n.a.	4,400
Trinidad Petroleum Development Company, Ltd.	3,522,143	3,265,805	58,717,905	6,789
United British Oilfields of Trinidad, Ltd.	6,544,501	5,929,319	116,477,316	10,849
C. D. Jones	90	.....	.....	....
Total	24,895,805	23,627,268	501,621,011	40,772

Drilling in Trinidad
(All Companies)

TYPE	WELLS COMPLETED IN 1955 Oil	Gas	Dry	Total	Percent Successful*
Development Wells	188	3	27	218	87.6
Exploratory Tests	2	3	5	10	50.0
Total	190	6	32	228	86.0

* Wells which discovered oil and/or gas are not necessarily commercial producers.

Important 1955 Oil Discoveries in Trinidad

OPERATOR	Well Name	Well Location	Basis for Location	Completion Date	Total Depth of Well (Feet)	Producing Depth (Feet)	Initial Production (Bbls./Day)	Gravity	Producing Formation (Name and Age)	Deepest Formation Tested	Name of Field or Pool	Exploratory Class	Remarks
Antilles Petroleum Co. (Trinidad), Ltd.	AO-8	Oropouche	Geology	Sept.	5517	2435–2538	154	28.7°	Retrench (Oligocene)	Retrench	Oropouche	Extension	Both of these wells considerably extended the productive limits of the field.
	AO-10	Oropouche	Geology	October	5515	2044–2108	164	29.2°	Retrench (Oligocene)	Retrench	Oropouche	Extension	
Dominion Oil, Ltd.	Mahaica No. 1	N. Central Trinidad	Surface Geology Seismic	March	6841	2995–3225	*	....	Springvale (U. Miocene)	Brasso (Miocene)	Mahaica	New Field	First discovery of hydrocarbons in Northern Basin.
	Mahaica No. 2	N. Central Trinidad	Sub-Surface Geology Seismic	October	10000	4350	*	....	Springvale (U. Miocene)	Brasso (Mio-Olig.)	Mahaica	New Pool	New Reservoir.
Trinidad Northern Areas Ltd.	HS-1 now renamed Soldado 1	High Seas Gulf of Paria	Seismic Gravity Geology	March	7500	4400–4800	160	34°	Cruse (Miocene)	Cruse (Miocene)	High Seas	New Field	Well
Trinidad Petroleum Development Co., Ltd.	Five Moruga Wells		Geology/Geophysical	Between April and Dec.	4400 (Max.)	Information not yet released			Cruse (Miocene)	Cruse (Miocene)	Moruga Bouffe	Semi-exploratory	Results obtained from these wells increased the promise of commercial production being obtained from this field, although this has yet to be established as a fact.

* Presence of gas established by drill stem tests. Both wells were suspended.

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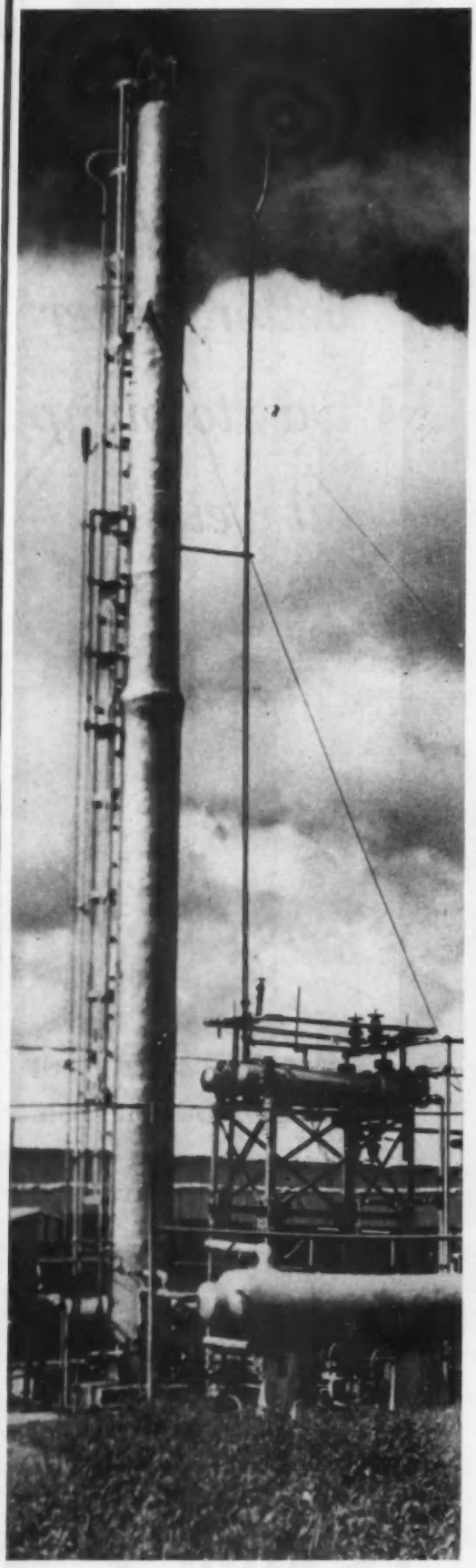
Argentina . . . Current government asks $250 million to rebuild industry. Future still in question



This gas stabilization plant is operating in the Salta field in Argentina.

THE ATTITUDE of the three Argentine governments that have been in power in Argentina during 1955 and 1956 toward development of the nation's oil by foreign capital has been a good yardstick to measure the mood of both the administration and of the public.

In mid-1955, what with then President Juan Peron in virtual agreement with Standard Oil Company of California's acquiring a concession in far southern Santa Cruz department and with the Argentine Congress being urged by Peron to ratify the agreement before the September 30 deadline, foreign capital appeared to have a foot in the Argentine door, long shut in favor of the government oil agency, Yacimientos Petroliferos Fiscales (YPF).

By September 30, the revolution that deposed Peron and later caused his exile, was in full swing—and with Peron, out went both the SoCal agreement and a similar pending deal with Standard Oil Company (New Jersey). Public bitterness, long suppressed by Peron toward his administration, seemed to break out in all directions. So there was no hope under provisional President Lonardi for foreign oil capital, which he repudiated in his first public remarks.

President Lonardi, however, was unable to reconcile the many conflicting factions, and resigned in favor of Gen. Pedro E. Aramburu. The new president's first feeling as to oil is that YPF should do the job of expanding Argentina's output, which has fallen far behind the nation's rising demand.

But as 1956 wore on, Aramburu became more realistically cognizant of the fact that the depleted Argentine treasury, which had gone into the red due to Peron's decade of control, simply was not equal to the task of furnishing funds to YPF.

By March 18, the government named a committee to study the SoCal agreement. The area involved would have been nearly 19,000 square miles in the extreme southwestern part of the mainland, near the Strait of Magellan, in the same sedimentary basin where the current production in Chile's portion of Tierra del Fuego field is located. The concession called for a 40-year term, a minimum expenditure by SoCal of about $13 million in Argentina, a 50-50 profit split between SoCal and the government, with oil to be exported only after domestic needs had been met.

On March 21, the Minister of Industry announced a $250 million expenditure plan intended to raise YPF's oil production from 25 million to 62.8 million barrels annually, within three years. YPF circularized 140 firms, including virtually all U. S., European, and Japanese equipment manufacturers, outlining its needs.

YPF intends to build, and asked for submission of bids by May 15, on the following:

- A $76 million, 1000-mile gas pipe line from Campo Duran field in the far northwest near the Bolivian border to Buenos Aires.
- A $19 million, 800-mile oil line from Campo Duran to the San Lorenzo refinery, near Rosario.
- Campo Duran manufacturing plants totaling $13 million.
- $15 million expansion of the Lujan refinery, near Buenos Aires.
- A new $18 million Buenos Aires refinery.
- A $9 million lubricant plant and storage tank construction.
- $76 million worth of drilling equipment.

The contracts would be made between the individual firms and YPF. The Central Bank of Argentina would guarantee all payments, and service and amortization charges incurred by YPF.

This blanket invitation represented one of the biggest individual requests for private capital investment in history. In considering the bids, YPF would first inspect the largest ones, those with lowest interest rates, and those with the longest amortization and initial repayment terms. YPF wanted $70 million in 1956, $90 million in 1957, $90 million in 1958, and to start repaying in 1959.

Some of the items included:

Geophysical drilling equipment,

REFERENCE

OIL FIELD

GAS FIELD

Single Oil Well

" " Gas "

Present Oil Pipe Line

Proposed " " " " "

Present Gas Pipe Line

Proposed " " " "

Refinery

Blueberry Mtn

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Ft St John

Sikanni Chief

Stuart Lake

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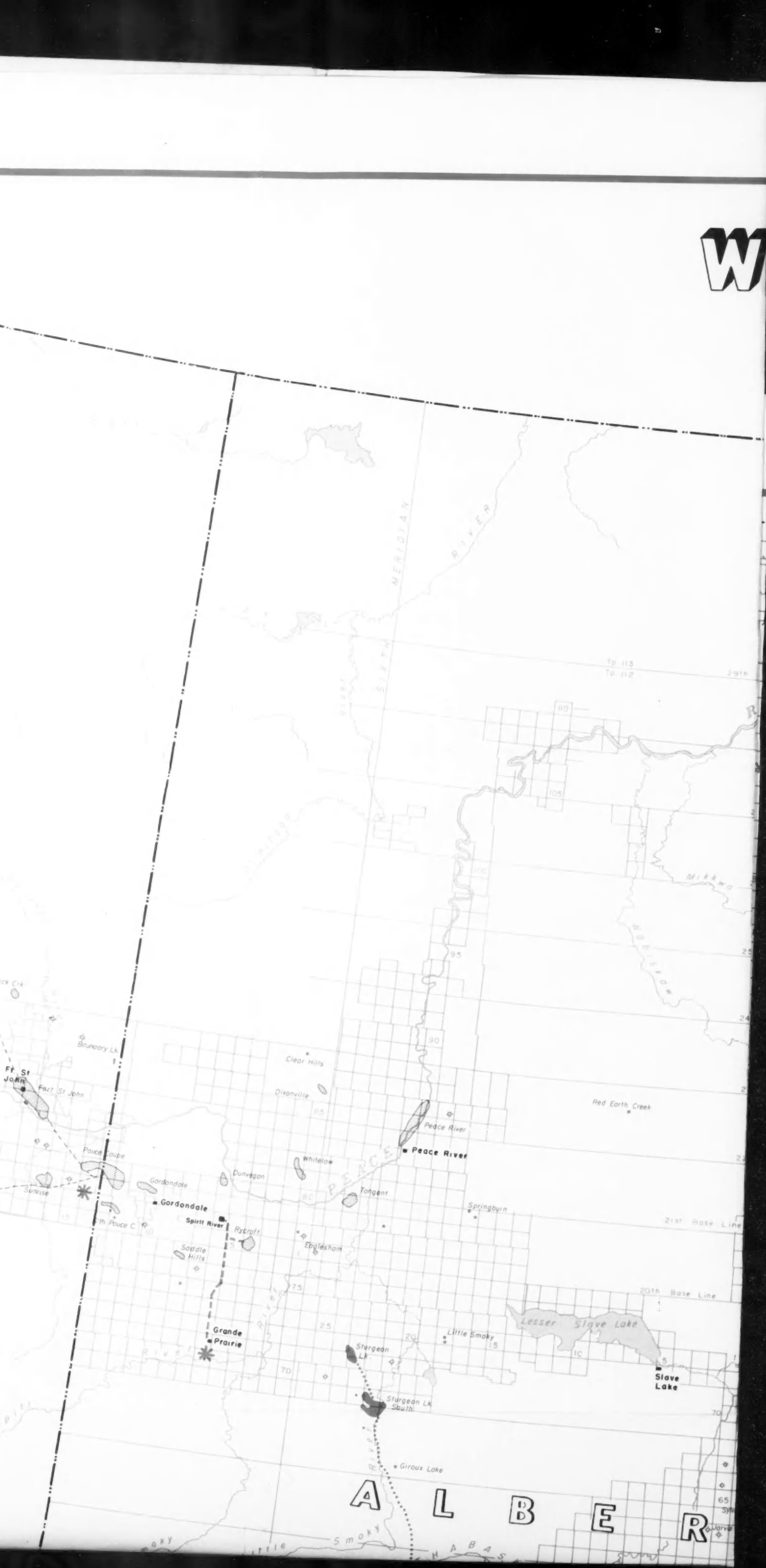
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Ft St John
Fort St John
Clear Hills
Dixonville
Red Earth Creek
Peace River
Peace River
Pouce Coupe
Whitelaw
Gordondale
Dunvegan
Tangent
Springburn
Sunrise
Gordondale
Spirit River
Rycroft
Eaglesham
Saddle Hills
Grande Prairie
Lesser Slave Lake
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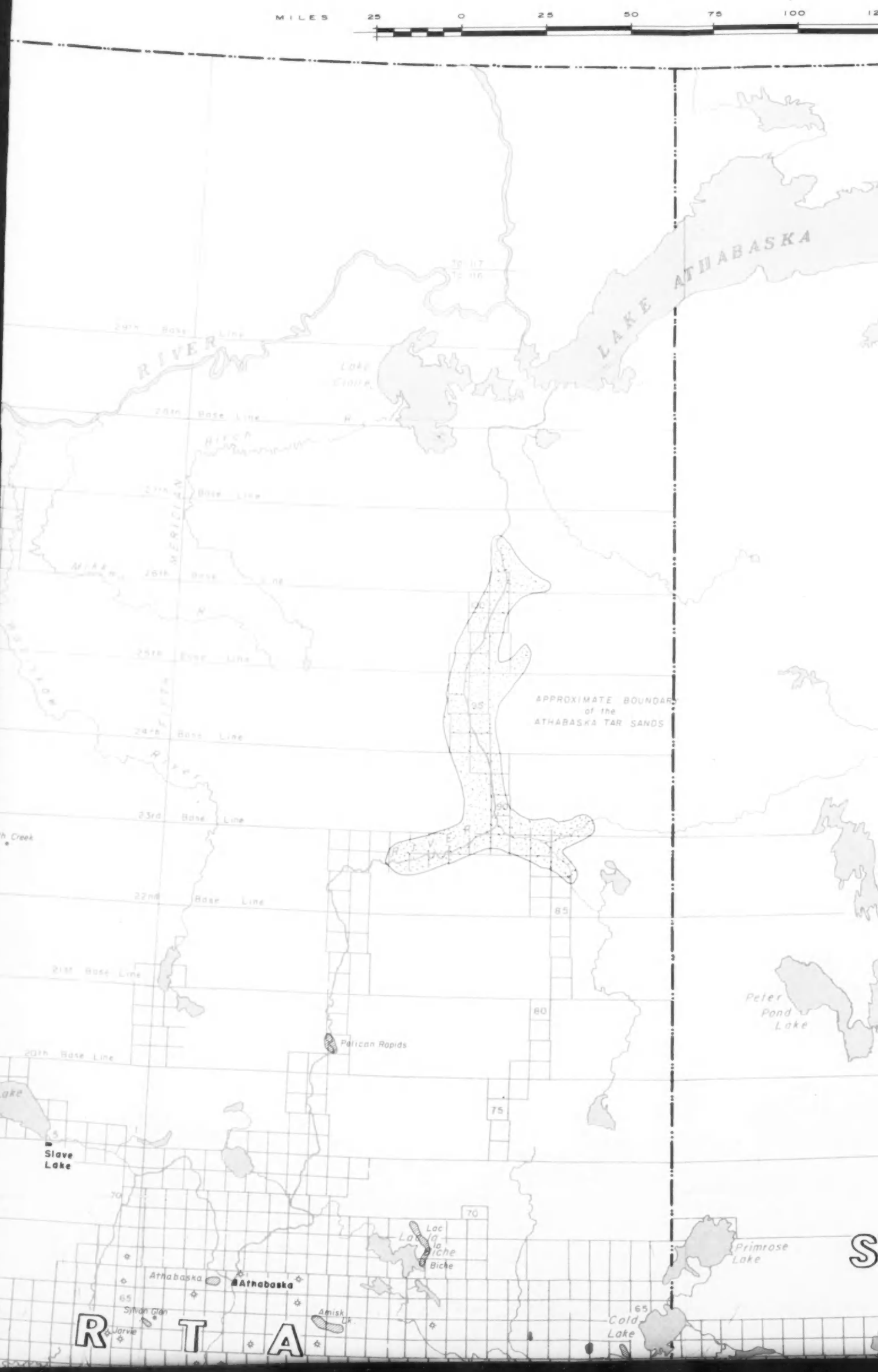

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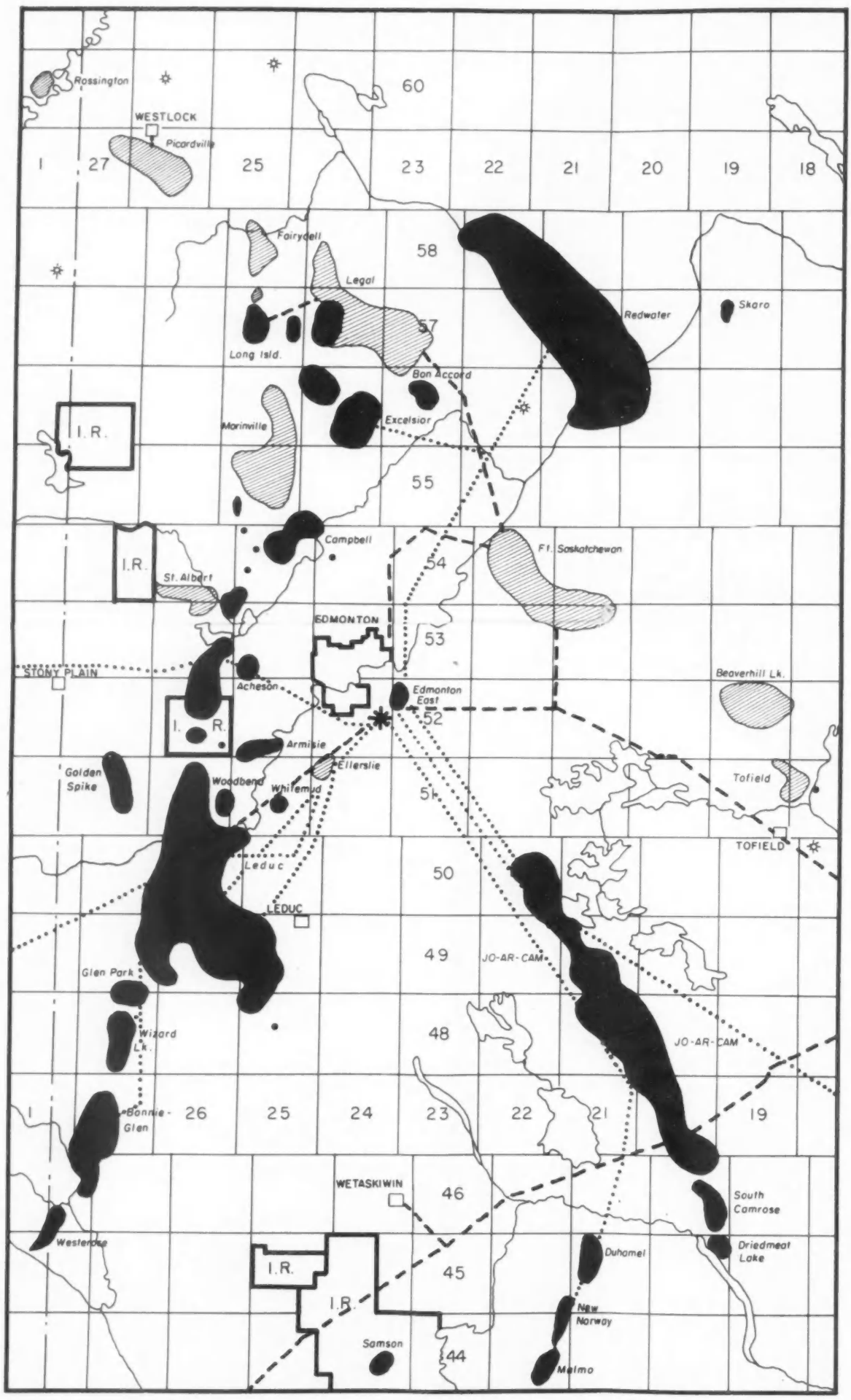


EDMONTON AREA

0 5 10 15 MILES

Lac la Range

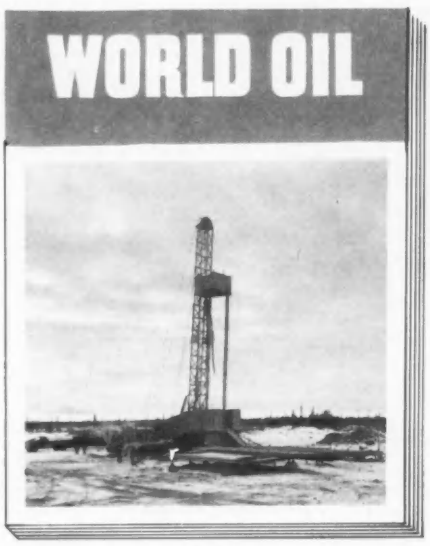
HEWAN

Montreal Lake

MAN

Reed L.

Moose Lake



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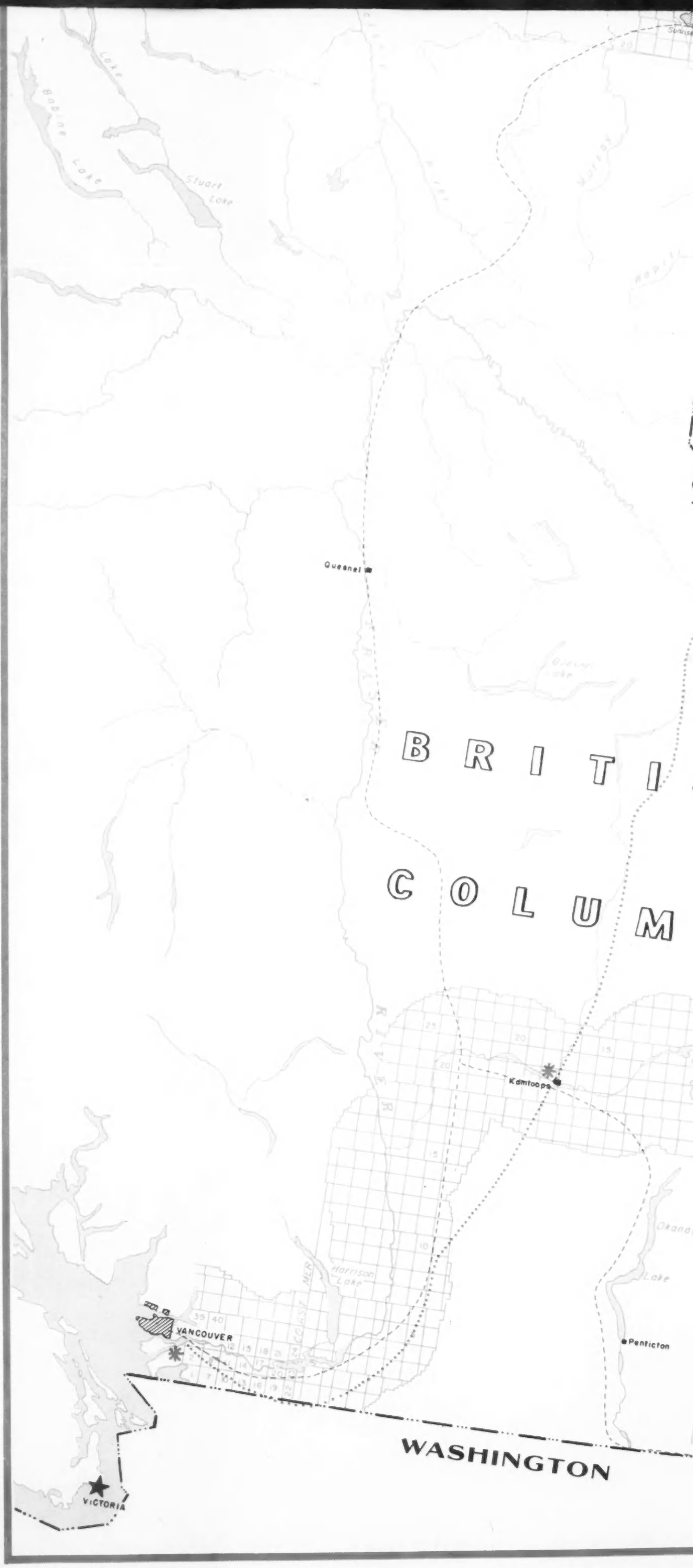
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VICTORIA
WASHINGTON

Gordondale
Sunrise
Gordondale
Spirit River
Rycroft
Eaglesham
Springburn
Tangent
21st Base Line
20th Base Line
Saddle Hills
Grande Prairie
Sturgeon Lk.
Little Smoky
Lesser Slave Lake
Slave Lake
Sturgeon Lk. South
Giroux Lake
A L B E R
Windfall
Barrhead
Glenevis
St. Ann
Pembina
Pembina
Buck Lake
Rocky Mtn. House
Brazeau
Homeglen
Rimbey
Sylvan Lk.
Gilby
Alhambra
Ferrier
Bentley
Sundre
Westward-Ho
Hermaton
Elkton
M B I A
Revelstoke
Shuswap Lake
Upper Arrow Lake
Okanagan
Lower Arrow Lake
Kootenay Lake
Nelson
Trail
Kettle River
Banff
Jumping Pound
Turner Valley
Savanna Crk.
Fernie
IDAHO
MONTANA

E R T A

S A

SEE INSERT IN N.E. CORNER FOR FIELD NAMES & PIPE LINES

EDMONTON

CALGARY

LETHBRIDGE

MEDICINE HAT

RED DEER

Lloydminster

Vegreville

Camrose

Wainwright

Stettler

Drumheller

Lacombe

Cardston

Kindersley

Borradaile

Athabaska

Slave Lake

Pelican Rapids

Cold Lake

Bonnyville

Elk Point

St. Paul

Vermilion

Viking-Kinsella

Forestburg

Alliance

Oyen

Sibbald

Hanna

Consort

Provost

Hamilton Lk.

Crosby Isle. Lk.

Compeer

Rosetown

Maidstone

Lone Rock

Jumping Pound

Turner Valley

Okotoks

Toronto

Countess

Princess

Brooks

Cessford

Tilley

Suffield

Medicine Hat

Bow Island

Foremost

Etzikom

Conrad

Monyberries

Pakowki Lk. Area

Spring Coulee

Pincher Creek

Del Bonita

Red Coulee

Aden

Black Butte

Conrey

Foosterton

Premier

Midway

Gull Lk.

Bone Crk.

Shaunavon

Dollard

Eastend

Rapdan

Turin

Barons

Tabor

Etzikom

Twelve Mile Crk.

Savanna Crk.

Pine Coulee

Mony Isle

Bindloss

Vee

Jellee

Jenner

Buffalo

Dunmart

Stevenville

Tilley

Eyremore

Twining

Ghost Pine

West Otheller

Otheller

Handhills

Wayne

Acme

Dowling Lk.

Link Lk.

Wimborne

Klingstal

Westward-Ho

Harmattan

Elkton

Glds

Sundre

Big Valley

Captona

Bashaw

Erskine

Jaffre

Alliance

Goose Lk.

Caston

Bulwark

Kessler

Muddy Lk.

Caldonah

Hawin

Homeglen

Rimby

Bentley

Gilby

Alhambra

Sylvan Lk.

Buck Lake

Beaverhill Lk.

Sylvan Lake

Athabaska

Edgerton

Saddle Lk.

Elk Point

Lea Park

Kitscoty

Marwayne

Paradise Valley

Primrose Lake

Peter Pond Lake

Churchill Lake

Lac La Biche

Lac La Biche

Barrhead

Glenevis

St. Ann

Redwater

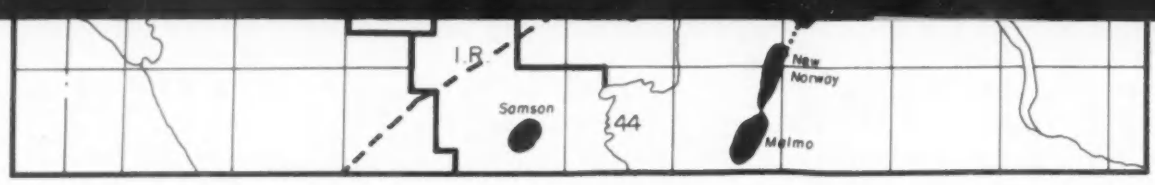
Fort Saskatchewan

Beaverhill River

North Battleford

MONTANA

Churchill Lake
CHURCHILL
Lac Ile a la Crosse
Snake Lake
I.R.
Samson
44
EDMONTON AR
0 5 10 15 MILES
Lac la Ronge
ASKATCHEWAN
Montreal Lake
Cumberland Lake
SASKATCHEWAN
Prince Albert
North Battleford
Tisdale
SASKATOON
Quill Lakes
Watrous
Battrum
Success
Conlugr
SWIFT CURRENT
REGINA
MOOSE JAW
Qu'APPELLE
River
THIRD MERIDIAN
Ralph
Middle
Kingsford
SOURIS
Ratcliffe
MONTANA



EDMONTON AREA

0 5 10 15 MILES

HEWAN

MAN

Lac la Range

Reed L.

Montreal Lake

Moose Lake

Cumberland Lake

Cedar Lake

SASKATCHEWAN

LAKE WINNIPEGOSIS

Prince Albert

Tisdale

Quill Lakes

Watrous

Kamsack

Dauphin

Qu'Appelle River

REGINA

MOOSE JAW

Wapella

Mirden

Roseau River

Woodnorth

Atlda

Nottingham

Tilston

Ingoldsby

Pierson

Waskada

Ralph

Midale

Stockmen

Kingsford

Frobisher

Hastings

Souris

Rapliffe

SECOND MERIDIAN

THIRD MERIDIAN

ASSINIBOINE

NORTH DAK

ONTANA

NITOBA
Utik L.
Knee Lake
Sipiwesk Lake
Gods Lake
Oxford Lake
Molson Lake
Island L.
Playgreen Lake
LAKE
WINNIPEG
Berens R.
Dauphin Lake
LAKE MANITOBA
Dauphin
Portage la Prairie
WINNIPEG
BRANDON
RIVER
SOURIS
PRINCIPAL
RED
RIVER
MERIDIAN
South Regent
Whitewater
Turtle Mtn.
AKOTA

$500,000; valves, $1,500,000; meters, $300,000; airport service units, $600,000; lube oil plants, $20 million; pipe line production equipment, $10.8 million; electrical equipment, $3 million; pipe, $1.5 million; transportation means, $1.5 million; tankers, tugs, etc. $10 million.

All these are itemized in a more comprehensive breakdown. In addition, aside from strictly YPF proposals, the ports of Rosario and Santa Fe were scheduled to be improved as soon as possible so that they may again accommodate large ocean-going vessels. The ports have been in disuse during the last ten years insofar as bigger ships are concerned, due to lack of sufficient dredging of the Parana river. Congestion of the Port of Buenos Aires would be relieved, and tanker traffic on the Parana may increase.

These events may bring far-reaching results for the oil business, regardless of whether YPF's production increases or whether foreign firms are admitted on a concession basis. Of significance is how rundown the industry is after a decade of Peronism. Otherwise, such huge sums would not be requested for maintenance items.

It was indicated, however, from emphasis on the extreme northwest oil fields, that large reserves had been proven by YPF in the nation's most land-locked region, the Campo Duran-Madrejones area.

Both crude and natural gas production in 1955 increased from 1954 figures.

In 1955, YPF produced 25,581,731 barrels of oil, for a daily average of 70,087 barrels. This represented 84 percent of the nation's output. The four private companies operating on limited concessions are two Argentine companies, Astra Cia. Argentina de Petroleo and Cia. Rio Autel "El Sosneado," Diadema Argentina S.A. de Petroleo (Royal Dutch Shell) and Esso Productora de Petroleo S.A. The Shell company produced 3,022,721 barrels in 1955, or 8722 barrels a day, from its Kilometro 27 Field in the Comodoro Rivadavia region during the year. Two flowing and 441 pumping wells were on production at Km. 27 at the year's end. Esso produced 342,370 barrels during the year, for a daily average of 938 barrels.

Crude Oil Production in Argentina

Field or Region	1955 Crude Oil Production (Barrels)	Barrels Daily, 1955	Barrels Daily, 1954	Percent of Change, 1955 Compared to 1954	Total Natural Gas Production in 1955 (Cubic Feet)	1955 Cubic Feet Daily	1954 Cubic Feet Daily	Percent Change, 1955 Compared to 1954
Comodoro Rivadavia	18,202,787	49,871	47,448	+5.1%	27,331,826,321	74,881,716	71,781,360	+ 5.4%
Mendoza	6,424,929	17,603	16,223	+8.5%	1,166,074,108	3,194,724	2,823,080	+13.1%
Neuquen	5,313,238	14,557	15,883	−8.3%	7,102,496,790	19,458,895	16,032,538	+21.4%
Salta	515,838	1,413	1,513	−6.6%	1,996,307,968	5,469,337	4,700,795	+16.3%
Total	30,456,792	83,444	81,067	+2.99%	37,596,705,187	103,004,672	95,337,773	+ .8%

Drilling. YPF drilled 1,348,731 feet of hole during 1955. Diadema drilled 125,509 feet, and Esso, 11,942 feet. YPF completed 228 wells, including 177 producers (168 oil and 9 gas) and 51 dry holes. This was a slight drop in number of wells from 1954, when 242 were completed, but only 166 became producers that year. YPF had 57 rigs running in 1955 and 56 in 1956. Diadema drilled 21 oil wells and nine dry holes in 1955, with 2 wells drilling at the year's end. Esso completed no oil wells, two gas wells, and a dry hole during the year. One Esso rig was active.

Bolivia . . . Crude production spirals despite lack of outlet.

HIGHLIGHTING BOLIVIA'S oil industry in 1955 was its spiraling crude production. Last year, the sharpening trend reflected an increase of 58.8 percent from 1954. Production of 2,692,414 barrels amounted to a daily average of slightly more than 7376 barrels, up 2732 barrels from the previous year. Underlining the importance of this sharp increase was the fact that in Camiri 21 wells capable of producing oil were shut in at year's end because of the lack of an outlet for the crude.

This significant trend was carried over into 1956, and in February the nation's production continued rising to 8800 barrels daily with a potential of approximately 12,000 barrels per day. Camiri contributed about 96 percent of this figure, Bermejo field 3 percent, and Sanandita was credited with 1 percent.

Seven rigs were active last year; however, four new ones were acquired in 1956. Total footage drilled in 1955 was 75,878 feet.

In Camiri three sands are producing—the Sararenda of about 100-foot thickness, repeated by an overthrust in the Santa Anita sand of similar thickness, and the Number 13 sand of about 25-foot thickness. The latter was reached only by Well 88, and produced about 500 barrels daily on test.

The proven crude reserves of the three sands, calculated at about 64 million barrels, were increased by the completion of Well C 104 in January, 1956. The well proved the continuation of the oilbearing Sararenda sand on the western flank of Camiri anticline and produced approximately 700 barrels daily. By adding an estimated 5 million barrels of crude reserves for the Guairuy field, total reserves of Camiri structure should exceed 70 million barrels. Reserves of the Sanandita and Bermejo fields depend on the result of deeper drilling in the lower Devonian block of Sanandita and Tupambi sandstone in Bermejo.

Twenty-one wells were completed last year, of which 19 produced oil and 2 were dry holes. Fifty-four wells were producing at year's end, with 30 being shut in. Wildcats were spudded in during March, 1956, on the Itapirenda closure between Camiri and Guairuy field and in Buena Vista, north of Camiri.

In the McCarthy concession, four wells have been drilled to date. One was a crude producer, one a gas well and two had not been completed. No new activity has been reported, and the agreement with Keljikan Commercial Company reportedly had not become effective.

However, Glenn McCarthy proposed several new projects—to build

This unique Jeep-powered rail car was especially developed for the Glenn McCarthy expedition in Bolivia. Getting on the track at Yacuiba, the vehicle speeds over narrow gage rails that run through the lease at 45 to 50 miles per hour driven by the Jeep's power take-off. At San Antonio, 16 miles from the drill site, the Jeep is detached from the rail car and driven as an ordinary vehicle. The unit saves hundreds of man-hours each week in transporting personnel over the bad roads in southeastern Bolivia. McCarthy is behind the wheel.

a 300 barrel daily refinery at Concepcion in Paraguay and connecting it by a 280-mile pipe line with the Monos field and later to construct a 500-mile gas pipe line to Chuquicamata in northern Chile to supply natural gas to the Anaconda Copper Company and the Anglo Lautaro Nitrate Corporation.

Recently, a contract was signed with International Petroleum Company of Peru to supply 10,000 barrels of gasoline a month through the new pipe line to La Paz and thence to Guaqui on Lake Titicaca for distribution in southern Peru.

The most important feature in Bolivia's future oil development was the enactment on Oct. 26, 1955, of the new petroleum law. Regulations of the new code went into effect Jan. 24, 1956. They include:

- Division of the country into four zones, each with tax rentals varying from 2 to 5 cents per hectare (1 hectare equals 2.471 acres).
- The fixing of royalty at 11 percent, which in Zones 2 and 3 could be reduced to 7.5 percent for the first 15 years.
- Establishment of income tax at 30 percent of the net. Total taxation is not to exceed 50 percent of the net earnings.
- Allowance of 27 percent depletion allowance.
- Permitting crude export free of tax.
- Permission to import all required material free of duties for entire concession period.

Of especial significance to U. S. oil companies, however, was the investments security agreement with the U. S. government under which the latter will guarantee investments up to $20 million.

A decisive step for the early development of Bolivian oil resources was the agreement with Gulf Oil Corporation of March 26, 1956, by which Gulf will invest up to $40 million in pipe lines, take out about 3.7 million acres under exploration concessions, invest a minimum of $1.2 million dollars annually in exploration, and select about 1.1 million acres for development operations under a plan calling for 11 percent royalty and a tax of 19 percent on all production at the wellhead.

This contract will run for 40 years, but it is subject to the approval under the new petroleum law and to the approval of the pipe line to Arica by the Chilean congress.

Several other companies, such as Socony Mobil Oil Company, Richfield Oil Company, Shell Oil Company of Peru, International Petroleum Company, and the Japanese Teikoku Oil Company, already have sent representatives and geologists to Bolivia to study the country's petroleum potential. Favorable development should be expected if the political atmosphere proves stable.

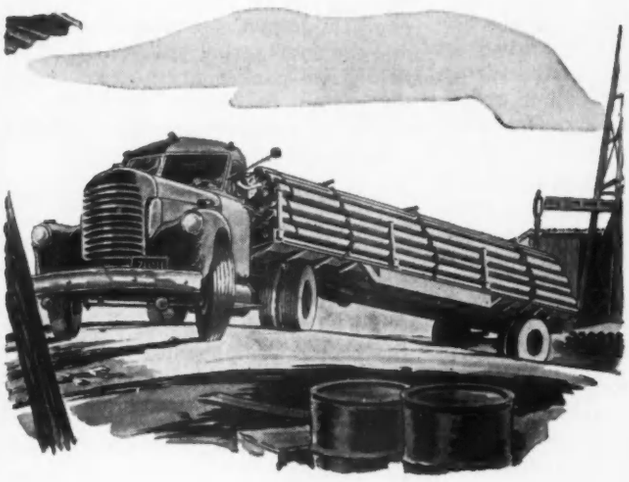
Oil Production and Drilling in Bolivia

FIELDS	CRUDE PRODUCTION: Year 1955	CRUDE PRODUCTION: Daily Average For Year 1955	No. of Crude Producing Wells at End of 1955	No. of Wells Shut in at Dec. 31, 1955	WELL COMPLETIONS: Oil	Gas	Dry	Total: Wells	Total: Footage
Camiri and Guairuy	.....	....	37	22	15	..	1	16	.....
Sanandita	.....	....	12	2	..	..	..	..	.....
Bermejo	.....	....	5	6	4	..	1	5	.....
Total	2,692,414*	7,376*	54	30	19	..	2	21	75,878*

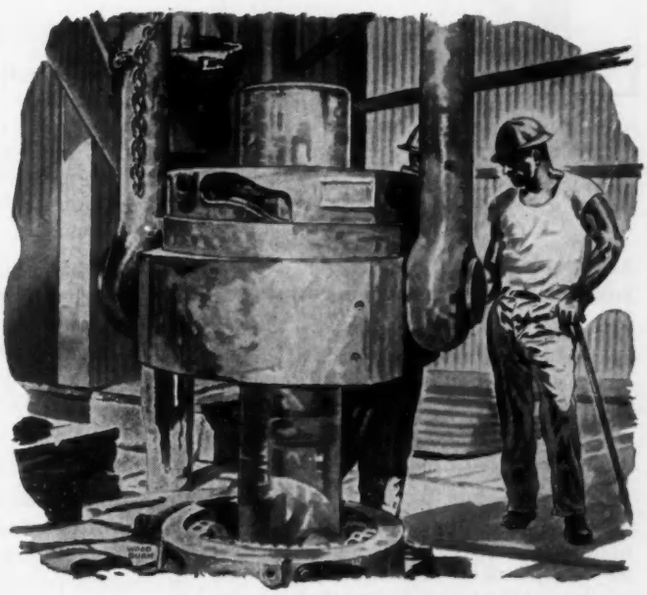
* Data by field was not furnished.

3 ways Youngstown helps you get the right casing and tubing

(1) Youngstown field engineers help you choose the right casing and tubing to give you the safety factors to fit your well conditions.



(2) Casing and tubing are delivered quickly from your nearby Youngstown distributor.



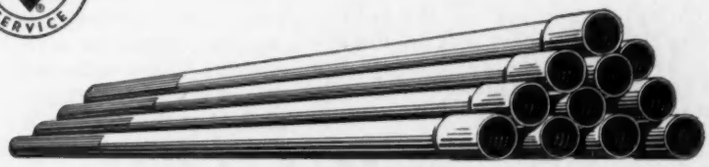
(3) You save by having the exact string you need. No more, no less. And you start operations knowing that the string has been engineered to the job.

Add it up. You're ahead with Youngstown Casing and Tubing. Next time you order, ask your Youngstown distributor for the casing and tubing with the orange band.

Made by pipe men. . . for pipe men

Youngstown

ENGINEERED CASING AND TUBING



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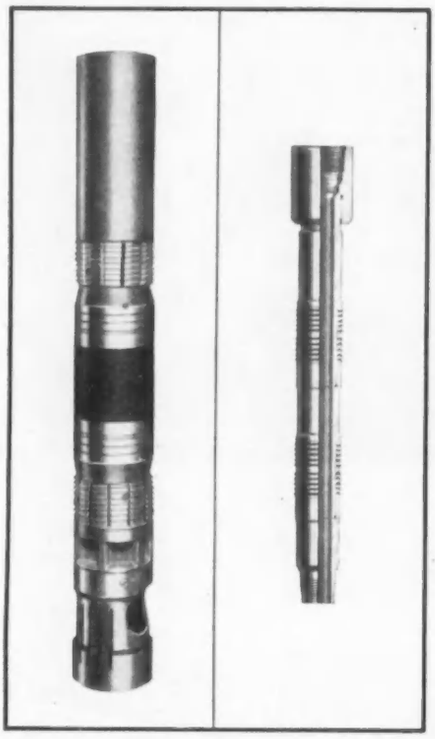
"Universal" Aptly Describes Range of Applications of BAKER Retainer Production Packer



Baker Retainer Production Packer
Product No. 415-D

Baker Locator Tubing Seal Assembly
Product No. 442-E2

ADVANTAGES of the Baker Retainer Production Packer:

1. *Forms positive, leak-proof pack-off against any pressure differential from either above or below the packer that is safe for the casing.*

2. *Pack-off achieved without excessive set-down tubing weight, or tubing in tension.*

3. *Permits tubing string to be anchored to the packer, released from the packer, or completely removed from the packer, all at the discretion of the operator.*

4. *Complete removal of the tubing string from the packer will not disturb the isolation of the zone below the packer, provided the pressure differential is from below the packer.*

5. *Pack-off remains leak-proof under conditions of high temperature, even under pressure differentials that exceed the safety limits of the casing.*

6. *Can be set on wire line, tubing or drill pipe.*

In practically every production application the Baker Retainer Production Packer has earned the designation "Universal" Type; and it appears also to be the answer to many future production problems.

The range of applications is further broadened by its ability to hold high pressures from above or below—at record or shallow depths—even under temperatures in excess of 300 degrees Fahrenheit.

Because it can also be used successfully as a squeeze tool, it is ideal for testing, acidizing, formation fracturing, squeeze cementing, and other operations required in the completion or work-over phases of a well.

The following actual field records of general production, as well as supplemental applications of this "Universal" Type Packer may indicate a solution to your well problems:

PRODUCTION APPLICATIONS

Single-Zone Production—More Baker Retainer Production Packers are used for single-zone production than for any other application—proof of their increasing and widespread usage in a field previously dominated by retrievable type packers.

Dual-Zone, Single-Packer Application—The majority of dual-zone applications of the Baker Packer are single-packer, dual-zone installations. Because of its remarkable ability to maintain the absolute separation of two zones, this packer is widely known and accepted as the ideal dual-zone packer.

Dual-Zone Production (Baker Selective Hook-Up), Two-Packer Installation—This efficient hook-up enables the operator to produce (pump or flow), treat (formation fracture, acidize, etc.), or test either zone selectively through the tubing, while simultaneously producing the remaining zone through the annulus. The switch in flow, or selection of a zone for treatment, is accomplished at the discretion of the operator, using an instrument line.

Permanent-Type Well Completions—Long recognized as the world's most permanent production packer, the Baker Retainer Production Packer was accepted early in the development of this new completion idea as OUTSTANDINGLY FIRST for Permanent-Type Well Completions.

Parallel Tubing Installations—When a *single* packer is used, each tubing string can be run or pulled independently of the other, and by using a special Anchor and a Latching Sub, the short string can readily be anchored to the long string.

When *two* packers are used, each string is run or pulled separately, however, the long string must be *run* first, and the short string *pulled* first. Either the single-packer or the two-packer installation features a full opening to the lower zone for use of all permanent completion-type tools.

Off-Shore Installations—The Baker Packer is used in conjunction with a storm choke to prevent loss of production due to accidental damage to surface connections of off-shore installations. Permanence, plus the ability of the packer to hold mud weight above the packer are additional factors that recommend its use in this application.

SUPPLEMENTAL APPLICATIONS

In addition to its use in practically every type of production application, the Baker Retainer Production Packer can also be used effectively as a squeeze tool in the following wide variety of "Supplemental" applications that might be required in the completion or work-over phases of a well:

Testing—As many as ten Baker Packers have been used in a single well for an efficient, complete bottom-to-top testing program. Ability of the packer to withstand reverse in pressure differential from high-pressure acid squeeze to swabbing enhances its use as a successful testing tool.

Acid Squeeze, Formation Fracture, or Squeeze Cementing—Use of the Baker Packer as a squeeze tool in either the initial completion or during subsequent work-over is widespread, due to elimination of the unnecessary additional expense of running a separate squeeze or testing tool.

Water Flood or Gas Injection—The permanence of the Baker Retainer Production Packer, plus the advantage of a free tubing string, make it a superior packer for secondary recovery instal-

(Advertisement)

lations. The packer has also been used in dual-zone wells where one zone is produced, with simultaneous injection into the other.

Isolation of Annulus—The Baker Packer is corrosion resistant. This feature, plus the fact that the packer permits removal of the production string without disturbing the isolation of the zone below the packer (pressure differential must be from *below* the packer) make it an ideal packer for use in corrosive areas where protection of the casing above the producing zone is of great importance.

Bridge Plug, Temporary or Permanent—The Baker Packer acts as a one-way bridge plug whenever the tubing is removed from the well, provided the pressure differential is from below the packer. It can easily be converted to a temporary two-way casing bridge plug or a permanent bridge plug.

POPULAR APPLICATIONS OF: the Baker "Universal" Type Retainer Production Packer

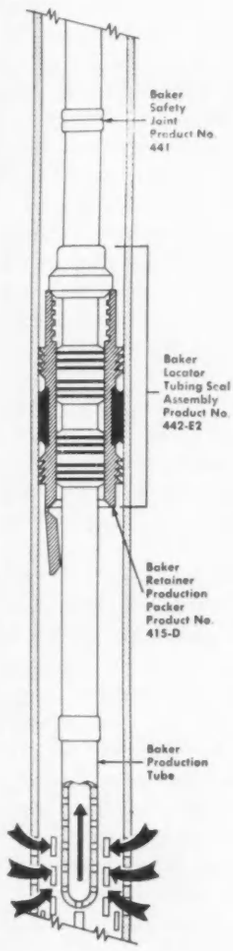

Baker Safety Joint Product No. 441
Baker Locator Tubing Seal Assembly Product No. 442-E2
Baker Retainer Production Packer Product No. 415-D
Baker Production Tube

Fig. 1

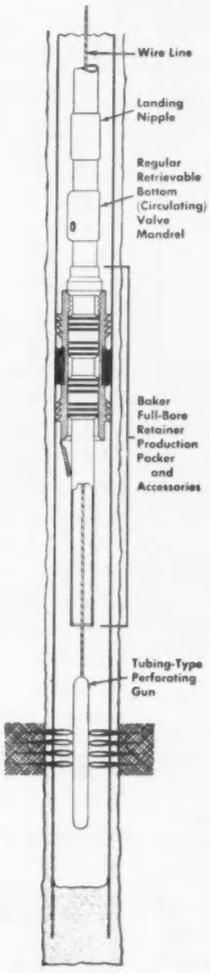

Wire Line
Landing Nipple
Regular Retrievable Bottom (Circulating) Valve Mandrel
Baker Full-Bore Retainer Production Packer and Accessories
Tubing-Type Perforating Gun

Fig. 2

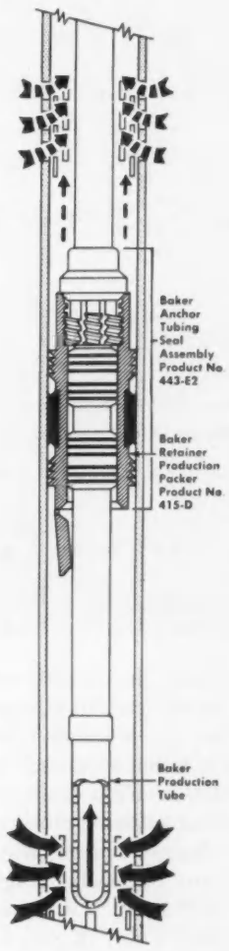

Baker Anchor Tubing Seal Assembly Product No. 443-E2
Baker Retainer Production Packer Product No. 415-D
Baker Production Tube

Fig. 3

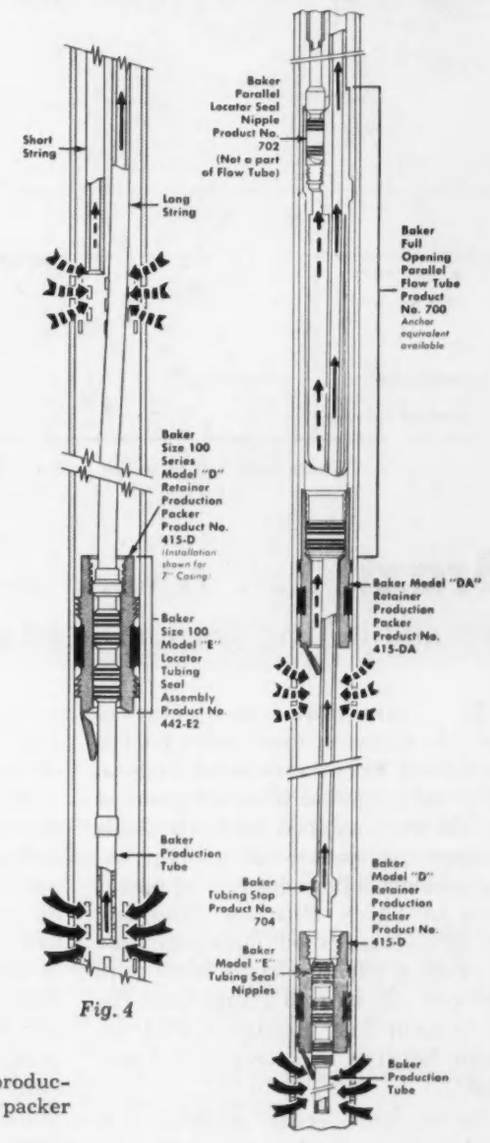

Short String
Long String
Baker Parallel Locator Seal Nipple Product No. 702 (Not a part of Flow Tube)
Baker Full Opening Parallel Flow Tube Product No. 700
Anchor equivalent available
Baker Size 100 Series Model "D" Retainer Production Packer Product No. 415-D
Installation shown for 7" Casing
Baker Size 100 Model "E" Locator Tubing Seal Assembly Product No. 442-E2
Baker Model "DA" Retainer Production Packer Product No. 415-DA
Baker Production Tube
Baker Tubing Stop Product No. 704
Baker Model "D" Retainer Production Packer Product No. 415-D
Baker Model "E" Tubing Seal Nipples
Baker Production Tube

Fig. 4

Fig. 5

SINGLE-ZONE Fig. 1.—Illustrates Packer set in casing with Locator Tubing Seal Assembly and Production Tube installed for single-zone production.

PERMANENT-TYPE WELL COMPLETION Fig. 2—Illustrates typical Permanent-Type Well Completion Hook-Up showing perforating operation through and below the packer.

DUAL-ZONE, SINGLE PACKER Fig. 3—Illustrates Packer set in casing with anchored production string for dual-zone production. Tubing can be released from packer by rotating to right.

DUAL-ZONE, PARALLEL STRINGS, SINGLE PACKER Fig. 4—Illustrates the simplest form of parallel string installation. A variation permits anchoring short string to long string, if desired. Note full opening to lower zone for use of all permanent completion-type tools.

DUAL-ZONE, PARALLEL STRINGS, TWO PACKERS Fig. 5—Illustrates two-packer parallel string installation with each zone confined to its individual tubing string, with full opening to lower zone for use of all permanent completion-type tools.

How to get complete information...

A new 72-page catalog supplement is now available on the Baker Retainer Production Packer and its many features and applications. Address any office, or ask your Baker representative for Baker Catalog Supplement No. 502.

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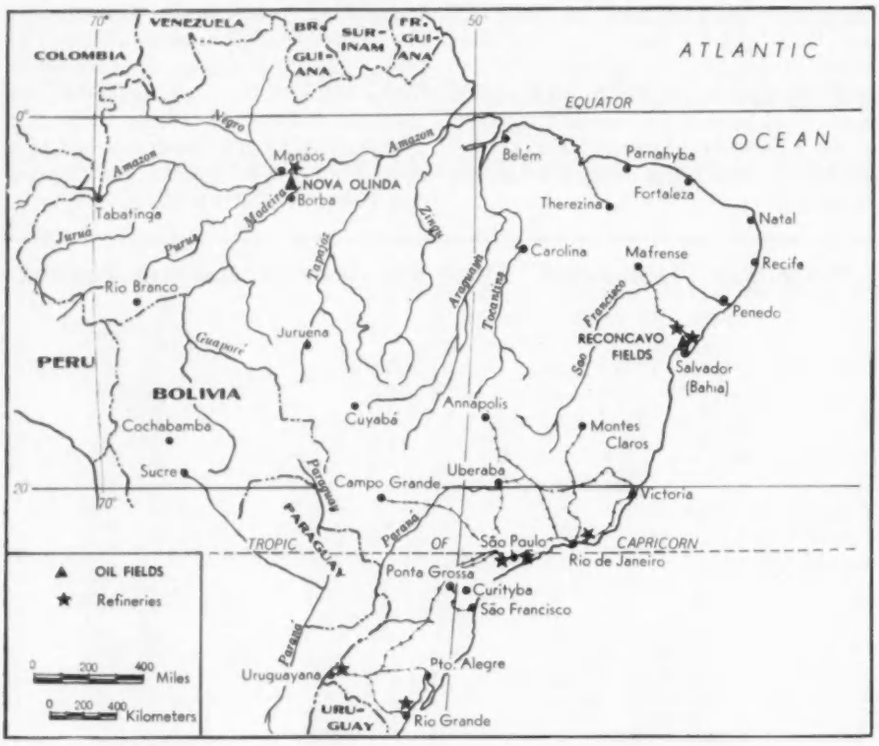

Thirteen wells will be drilled in the mid-Amazon river region.

Brazil . . . Petrobras undertakes record exploration and drilling program to offset imports.

IN A THOROUGH-GOING effort to save the dollars it must spend for imported oil, Brazil announced early in 1956 the largest drilling program in its history combined with its single greatest exploratory effort. This announcement followed a year of operations in which Petroleos Brasiliero, the government's oil monopoly, saw its crude production climb more than 100 percent, its well completions rise 30 percent and footage drilled increase between 6 percent and 7 percent.

Its domestic crude production is one of the critical facets of Brazil's economic structure. The basic commodity for export is coffee, which accounts for 56 percent of national income. However, 28 percent—or half—of the revenue from coffee exports are channeled out of the country to pay for the $105 million worth of imported oil that Brazil buys each year.

So the serious dollar shortage is hampering national development. Oil produced in Brazil could be paid for in Brazilian currency which would allow the country many more dollars to purchase the machinery, power plants, transportation equipment, and other material it needs from abroad.

Thus it is that Petrobras has undertaken such a wide scale exploration and drilling effort. Petrobras, headed by Col. Janary Nunes, who assumed his position upon the resignation of Col. Arthur Levy, is a monopoly only in the production of oil. Companies from abroad handle most of the importing and marketing operations. Approximately half of the domestic consumption is refined in Brazil, and the remainder is imported as products. Domestic refineries, owned by Petrobras or private national capital, can handle less than half of Brazil's current domestic consumption of all oil and oil products of approximately 200,000 barrels per day.

Petrobras' new exploration program will be concentrated in the Amazon basin. There, six rigs were scheduled to be in operation on separate wildcat prospects within a radius of 300 miles of the Nova Linda discovery.

Nova Olinda 1, the discovery well which was completed early in 1955, initially produced 250 barrels of 40.9-gravity crude daily from 8917-9002 feet. The discovery is referred to as Nova Olinda because of its proximity to the town of the same name on the Madeira river about 75 miles from Manaus. It was completed in carboniferous sandstone, and it is producing through 2½-inch tubing set inside 5½-inch casing. Drilling and Exploration Company, Inc., was the contractor.

Managing director of Petrobras is Helio Beltrao, and guiding the agency's burgeoning effort to find oil is Walter Link, formerly chief geologist for Standard Oil Company (New Jersey).

The exploration program calling for about 230,000 feet of drilling at a cost of approximately $20 million and requiring 19 geophysical exploration parties—including a number from the U. S.—was expected to include 31 wildcat tests. To simplify and correlate the effort, Petrobras has set up headquarters in Rio de Janeiro as well as in six operating districts. The districts and number of exploratory tests to be drilled in each are:

1. and 2. Mid-Amazon area and Belem, 13 wells.

3. Northeast coast basin—Matal, 2 wells.

4. Alagoas, 2 wells.

5. Bahia, currently a producing area, 12 wells.

Brazil Production and Drilling in 1955

MONTH	Crude Oil Production	Barrels Per Day	Wells Drilling at End of Month	WELLS COMPLETED IN 1955					
				Oil	Gas	Dry	Strati-graphic	Total	Footage
January	145,000	4,677	11	5	1	2	2	10	15,427
February	133,976	4,785	14	2	0	0	0	2	13,255
March	169,946	5,482	11	1	1	2	1	5	18,343
April	161,852	5,395	9	4	0	0	3	7	13,018
May	143,993	4,645	10	2	1	0	5	8	12,260
June	157,284	5,243	8	2	0	4	2	8	15,932
July	169,533	5,469	9	3	1	1	3	8	10,062
August	166,504	5,371	7	2	0	1	2	5	10,630
September	166,333	5,544	7	2	0	2	2	6	11,627
October	198,640	6,408	8	2	0	0	1	3	16,348
November	189,135	6,305	8	2	0	2	1	5	15,256
December	211,675	6,828	11	6	0	0	0	6	22,123
Total	2,013,871	5,517	..	33	4	14	22	73	174,281

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6. Parana (southern basin), 2 wells.

1955 Results. Last year, Petrobras boosted production from an average daily rate in January of 4677 barrels to 6828 barrels in December. Crude reserves as of Mid-Year 1956 were estimated at 33 million barrels.

Likewise, footage drilled rose significantly from 15,427 feet in January, 1955, to 22,123 feet in December. Total footage for the year of 174,281 feet resulted from the drilling of 73 wells.

Of the total number of wells drilled, 33 discovered oil, 4 were gas wells, 14 were dry holes, and 22 were stratigraphic wells. The greatest number of wells were completed in January, when the month-end figures showed that 5 oil wells, 1 gas well, 2 dry holes, and 2 stratigraphic tests had been drilled. Average depth of the wells drilled last year amounted to 2387 feet, 532 feet less per well than the average of the 56 wells completed in 1954.

The cumulative footage drilled at year's end amounted to 1,350,637 feet resulted from the drilling of 509 wells. Of this total number of wells drilled, 296 were oil producers, 34 found gas, 117 were dry holes, and 62 were stratigraphic wells.

Chile . . . Proposed bill would open country to private foreign capital.

WITH MAJOR INCREASES recorded during 1955 in almost every phase of its oil industry operations, Chile in 1956 was contemplating legislation designed to step up its oil pace through a law which would open the country to private foreign capital operations.

A new petroleum statute drafted by the Executive department and submitted to the Chilean congress last year would have opened the nation to private foreign company operations. But the legislation was withdrawn by the president without the Chilean congress having taken any action. Since then, the executive department has been drafting an amended bill and was expected to submit it to the congress in 1956.

Heretofore, Chile, like Argentina and Brazil, has refused to grant concessions to foreign oil companies, and considerable resistance was expected in congress.

Empresa Nacional del Petroleo, the government oil monopoly, produced 2,576,797 barrels of crude in 1955 for a daily average output of 7060 barrels. This amounted to an increase from 1954 of 48 percent.

While production climbed and controversial discussions over the proposed new oil law continued, Empresa continued its exploration and development efforts. During 1955, a total of 389,740 feet was drilled, up 101,154 feet—or 35 percent—from the previous year's total of 288,586 feet.

This increased drilling resulted in the completion of 58 wells, of which 25 were oil producers, 8 were gas wells and 25 were dry holes. During 1954, 40 wells were completed with 14 having found oil, 2 being brought in as gas producers and 24 having been dry holes.

Empresa reported four rigs active in development work and one in exploration. Average depth of the wells completed last year was 6720 feet as compared to an average of 7215 feet in 1954. Santa Fe Drilling Co. is the contractor for Empresa.

Other developments included:

- Steady development of the Magellan fields in the south near Punta Arenas, which were extended by discovery of new Cullen and Flamenco pools.

- Discovery of small pools in Primavera Victoria Este and Nandue. A Nandue discovery west of Flamenco was the area's first natural gas discovery.

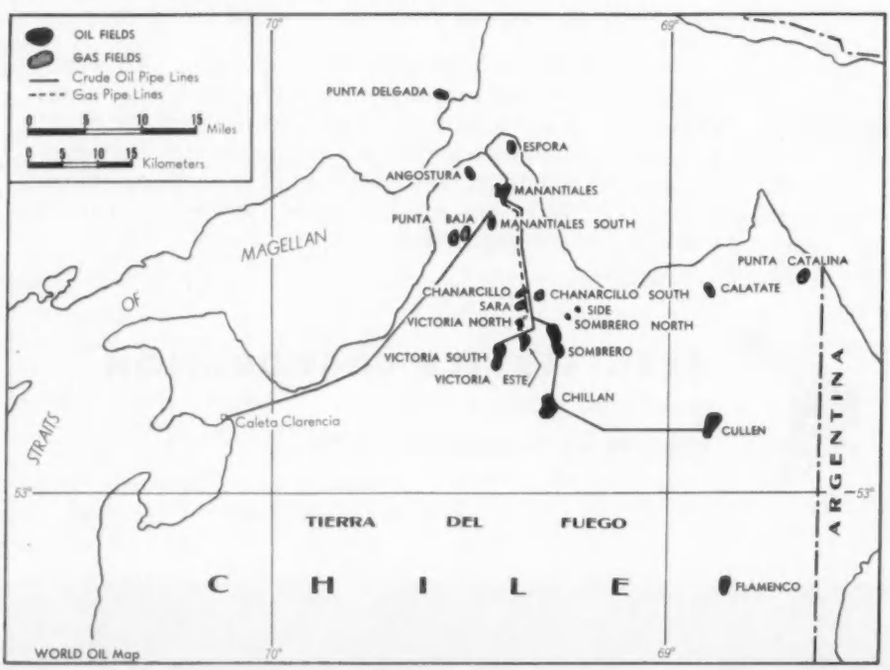
At the close of 1955, 93 wells were capable of producing crude, of which 42 were in production. Thirty-five natural gas wells were producing at the same period. Forty-one wells were shut in.

Continuing exploration resulted in the drilling of 13 wildcats, of which none found new oil, 11 were dry and 2 discovered natural gas.

Drilling and Production in Chile

YEAR	Annual Crude Production (in Barrels)	Daily Crude Production	RIGS ACTIVE		WELLS COMPLETED				Footage Drilled
			Exploration	Development	Oil	Gas	Dry	Total	
1955	2,576,797	7,060	1	4	25	8	25	58	389,740
1954	1,736,242	4,757	3	2	14	2	24	40	288,586
Increase	840,555	2,303	..	2	11	6	1	18	101,154
Percent of Increase	48.4%	48.4%	..	100%	78.6%	300%	4.2%	45%	35.1%

Average Depth: Footage/Completion: 1954—7215 feet; 1955—6720 feet.



CHILE . . . Discovery of new Cullen and Flamenco pools has highlighted the steady development of Magellan oil fields.

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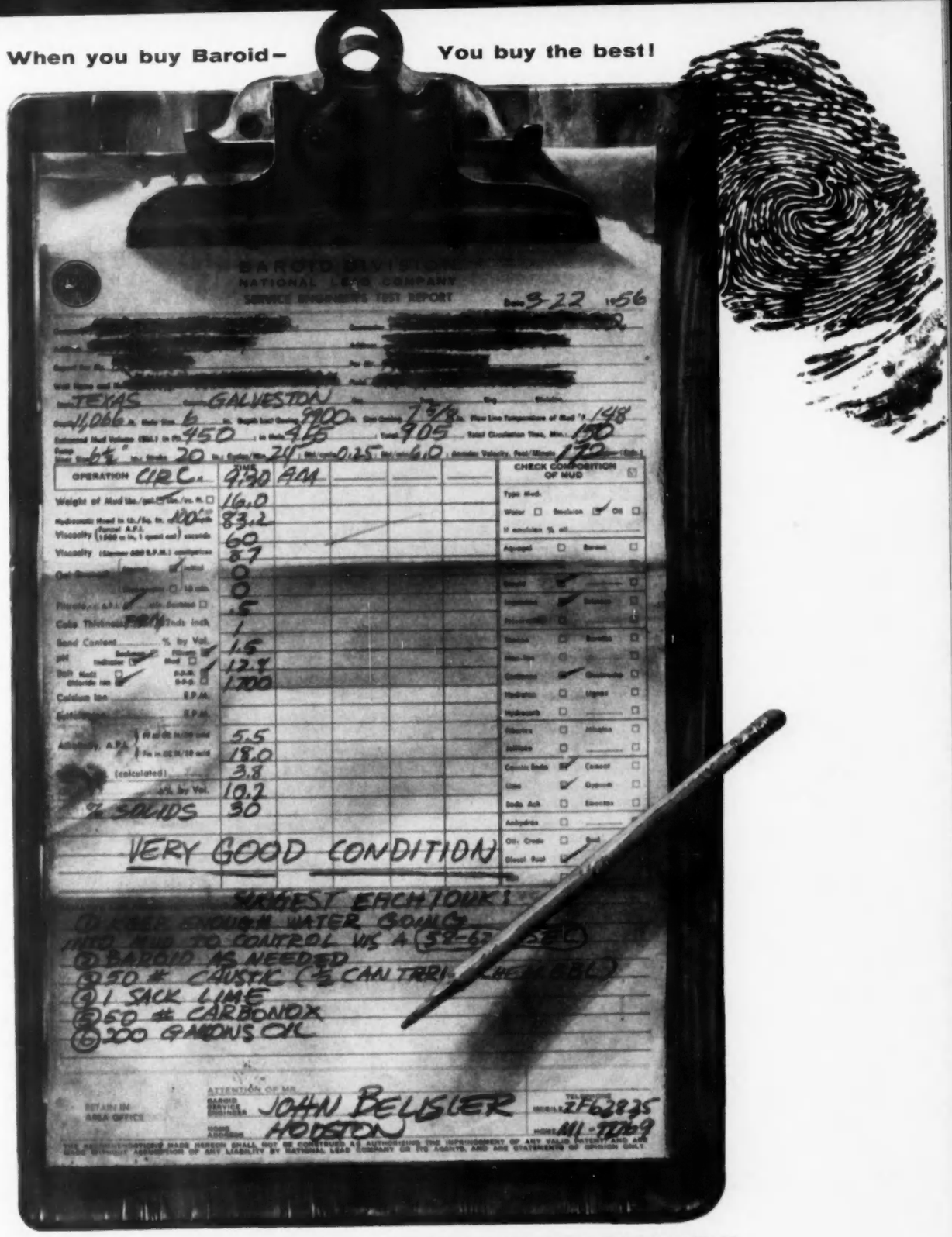

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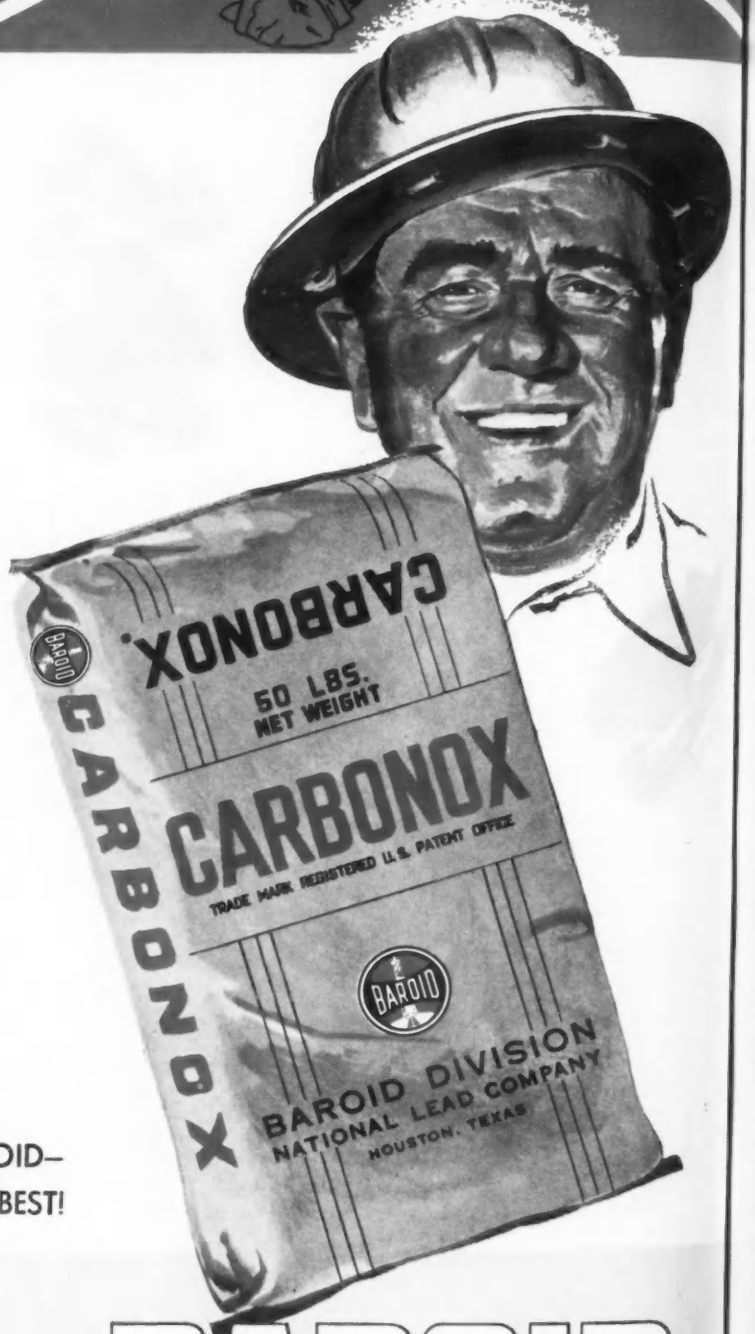

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Colombia . . . Three factors help oil industry.

The La Esperanza 1 wildcat, located 53 miles from Tibu southwest of the Barco concession in Colombia, was spudded March 23 and now is drilling. Geology indicates a 30,000-acre closed structure, with possibilities of a huge field if proved up.

RECENT DEVELOPMENTS in Colombia's petroleum industry have revolved around revisions in its oil law, progress in secondary recovery and the continuing interest of private capital from abroad. And in April, 1956, interest of oil circles was aimed squarely at wildcat tests that were under way—solid proof of the nation's active exploration program.

In 1954 the government appointed a committee to study the oil industry's request for an adequate and equitable depletion allowance, which at one time was 5 percent of net income and later was increased to 10 percent of gross income with a ceiling of "not exceeding 20 percent of the net." The result of several years efforts on the part of the industry was Decree 617 of March, 1955, which raised the ceiling to 35 percent and to 50 percent for Llanos income, if and when any developed.

In view of the deficiencies of this decree in creating incentives for greater oil exploration, taxwise, another decree was issued—Decree 2140 of Aug. 3, 1955—which fundamentally corrected the depletion legislation. It established by law the 50-50 split for Colombia and 40-60 split for Llanos operations.

The basic thought behind the decree was that if the oil companies undertook further oil exploration and obtained new oil production, they would be allowed greater deductions. For the Llanos—900 miles from tidewater—depletion was set at 27½ percent less 3 percent for royalty and a ceiling of "total royalties and income taxes" of not more than 40 percent of net income before taxes.

The decree also reduced pipe line tax from 4 percent to 2 percent for Llanos oil transportation. While this was aimed at increasing exploration, the industry would like to see certain wording of the decree corrected so as to erase any misunderstanding of the ultimate effects of the tax incentives measure.

Secondary Recovery. A contract was agreed to with Forest Oil Corporation of Bradford, Pa., for secondary recovery by water-flooding in the former de Mares concession. An investment estimated at almost $60 million was scheduled to be anted up by Empresa, which operates the concession, and Forest Oil on a 50-50 basis. Profits were scheduled to be divided at a ratio of 62.5 percent and 37.5 percent, with the larger share going to Empresa.

Private Capital. John W. Mecom, Houston, Texas, oilman, has acquired four concessions totaling about 500,000 acres on the Caribbean coast. The area was obtained from Empresa, which retained an over-riding royalty of 5 percent. Capital for development reportedly will be furnished at 75 percent by Mecom and 25 percent by Empresa.

Exploration. Exploration in Colombia has been active, and in April, 1956, these wildcats were being drilled:

1. Socony Mobil Oil Company's Chagui well on the southern Pacific coast, near Tumaco, was drilling ahead at 13,000 feet.

2. Socony Mobil's Vijagual well in the middle Magdalena valley.

3. International Petroleum Company's Reforma 1 well north of the former de Mares concession.

4. Texas Petroleum Company's Well 2 on the Caipal discovery north of its Velasquez field.

5. Colombian Petroleum Company's well in the Mercedes area south of its Barco concession.

6. Empresa Colombiana de Petroleos' Quebrada Roja wildcat in the northern area of the de Mares concession.

Of the wildcats completed in 1955, two were significant discoveries: Texas' Caipal test discovered 200-barrel-a-day production in a 16-

Crude Oil Production in Colombia

COMPANY	PRODUCTION IN BARRELS				
	Year 1955	Daily 1955	Year 1954	Daily 1954	Cumulative Through 1955
Shell Oil Company	14,702,799	40,282	16,356,401	44,812	n.a.
Empresa Colombiana de Petroleos	11,254,141	30,833	11,599,417	31,779	465,162,140
Colombian Petroleum Company	9,440,370	25,864	9,630,737	26,386	112,058,382
Texas Petroleum Company	3,923,163	10,748	1,874,330	5,135	n.a.
International Petroleum Company	42,529	117	159,917	438	n.a.
Total	39,363,002	107,844	39,620,802	108,550	.....

gravity pool at 6498 feet in the Ermitaño block, north of Velasquez. Lebrija 1, a Socony Mobil test, produced 301 barrels a day of 27-gravity crude at 6842 feet. Texas completed its Cucuana 1 in the upper Magdalena valley in the Tetuan block for 3.2 barrels a day of 24-gravity oil.

At year's end, International Petroleum was drilling Cacao 1 at 8844 feet, and Socony Mobil was drilling ahead at its Chagui 1 test on the Pacific coast.

Production. Colombia's crude production decline 0.7 percent in 1955 to 39,363,002 barrels, or a daily average yield of 107,844 barrels. In 1954 production of 39,620,802 barrels amounted to daily average of 108,550 barrels. However, 1956's output rate increased in April to 119,050 barrels a day.

Estimated proved crude reserves at mid-year 1956 were put at 525 million barrels. A total of 1809 oil wells was producing at the end of 1955.

Shell's Casabe field remained the principal producer last year with an output of 12,824,882 barrels, which was a decline of about 15 percent from 1954. Shell crude yield of 14,702,799 barrels came from Casabe, Cantagallo, Dificil, and San Pablo fields. Development of its new Yarigui field, opposite Cantagallo on the Magdalena river, proved successful, yielding in March more than 3000 barrels daily from two wells.

Empresa's production from the former de Mares concession and Colombian Petroleum's Barco concession declined slightly. But Texas Petroleum Company's output increased to 3.9 million barrels after the new pipe line to Galan went into operation. The new pipe line offers an outlet for production to the Caribbean coast through a connection with the Andian pipe line.

In April, 1956, Texas Petroleum's output reached 22,014 barrels a day, as compared with about 26,000 barrels a day by Colombian Petroleum, almost 30,000 barrels daily from Empresa and almost 41,000 barrels per day from Shell.

International Petroleum's production from its Totumal and Agua Chica oil fields remained small, totaling 42,529 barrels in 1955.

Drilling in Colombia

COMPANY	WELLS COMPLETED IN 1955						Total		Wells Completed in 1954	Footage Drilled in 1954
				Wildcats						
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage		
Shell Oil Company	11	0	1	0	0	4	16	95,029	5	54,149
Empresa Colombiana de Petroleos	24	0	1	1	0	2	28	145,433	26	109,992
Colombian Petroleum Company	40	0	0	1	0	0	41	251,687	40	218,222
Texas Petroleum Company	17	0	1	6	0	2	26	182,655	40	287,559
International Petroleum Company	1	0	0	0	0	3	4	34,143	11	80,780
Richmond Oil Company	..	..	..	..	..	..	..	.....	1	8,796
Socony-Mobil Oil Company	0	0	0	1	0	0	1	13,972	..	.....
Texon Company	0	0	0	0	0	1	1	2,986	..	.....
Total	93	0	3	9	0	12	117	725,905	123	759,498

Average Depth: Footage/Completions: 1955—6204 feet; 1954—6175 feet.

Paraguay . . . Productionless country may provide outlet route for Bolivian crude.

No DRILLING or exploration activity was reported from the land-locked little Guarani Indian nation of Paraguay in 1955. Union Oil Company of California did some unsuccessful drilling in the Chaco region several years ago, which, however, did not condemn the Chaco's possibilities.

Pursuant to a barter agreement with Bolivia, the latter sent 1861 barrels of motor fuel, kerosine and diesel fuel to Paraguay in 1955, in exchange for foodstuffs.

Construction of a 350-mile pipe line from Villa Montes, just north of Los Monos field in Bolivia, to Concepcion, above Asuncion on the Paraguay river, has been proposed. However, it is doubtful that such an expensive project can be justified since some products are being trucked over a road between these two points.

Paraguay's consumption is minor and it has no refineries. This route represents a possible outlet, however, for Bolivian crude, as a project is planned to provide a river barge transportation system for the Paraguay river. Crude could conceivably be barged downstream to Parana-Plata river area refineries in Argentina and Uruguay, provided sufficient crude could be put down economically at Concepcion, and all four nations involved would support the project.

Ecuador . . . Reserves stand at 25 million barrels. Government pact calls for refinery construction.

EXPANDING EXPLORATION activity and drilling have combined to shove Ecuador's estimated proved crude reserves to an even 25 million barrels. Despite crude production last year of 3,530,622 barrels—a daily average of 9673 barrels—reserves climbed 1.5 million barrels from the previous year.

At year's end, 1457 oil wells were producing as compared to 1452 producers at the same time in the previous year. With 8 wells drilling at year's end, a total of 216 well completions was recorded last year. Of the 216 wells, which reflected a 27 percent increase in number of completions from 1954, 200 were oil producers, 1 was a gas well and 15 were dry holes.

An agreement had been reached between Anglo Ecuadorian Oilfields Ltd., a British company, and the Ecuadorian government covering Anglo Ecuadorian rights to continue development of its fields, refinery operations and marketing. Details had not been made public, but it was understood that the pact will call for the construction of a new and modern refinery to fulfill local requirements of about 5500 barrels a day.

During 1954 Ecuador's crude production averaged 8620 barrels a day of which Anglo Ecuadorian accounted for 6679 barrels daily and Manabi Exploration Company, Inc., a Pantepec Oil Company subsidiary and Ecuador's second largest producer, accounted for 1057 barrels a day. The balance was produced by the three remaining companies—Carolina Oil Company, Concepcion Ecua-

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Manabi, however, in 1956 reported that its crude production was averaging approximately 2300 barrels daily. In 1955 Manabi made its second discovery of the year on its San Raimundo concession when a test well flowed at a rate of 96 barrels a day of 48-gravity crude from 988 feet. In March, 1955, the company completed its first discovery in the San Raimundo area, Santa Elena peninsula, which was good for 100 barrels daily of 48-gravity crude. The company's drilling program was scheduled to continue at San Raimundo and El Tigre fields, where several locations had been staked.

Ecuador's two refineries—topping plants owned by Anglo-Ecuadorian and Manabi—have a combined total daily crude charging capacity of 6050 barrels. Daily average crude runs during 1955 amounted to 4800 barrels. Imports of about 700 barrels daily made up the balance.

Production in Ecuador

	Annual Production (in Barrels)	Daily Average Production (in Barrels)	Wells Producing
1955	3,530,622	9,673	1,457
1954	3,146,453	8,620	1,452

Drilling in Ecuador

YEAR	WELLS COMPLETED				Footage	RIGS ACTIVE		No. of Wells Drilling at End of Year
	Oil	Gas	Dry	Total Wells		Development	Exploration	
1955	200	1	15	216	332,200	7	1	8
1954	163	1	6	170	260,980	9	..	..

Peru . . . Search concentrates in Montana as tests elsewhere fail.

Oil operations during 1955 and 1956 aimed at discovering new crude sources in Peru have resulted in a three-way disappointment:

1. Concessions in the Sechura were being abandoned because drilling operations have brought no positive results.

2. Exploration in the Pisco-Nazca areas in southern Peru, conducted by International Petroleum Company-Sea Oil, has failed to reveal any promise of prospective areas.

3. Poor results of offshore drilling by Douglas Oil Company has led to the anticipation by Peruvian oil circles that operations will be halted.

Possibly as a result of these reverses, interest is concentrating in eastern Peru's Montaña, where the biggest bulk of concessions in South America has been assembled.

Production. Peru's crude output last year reflected a less-than-1-percent increase from 1954. Production amounted to 17,245,534 barrels in 1955, or 47,248 barrels per day average. In 1954, production of 17,161,524 barrels resulted in a daily average yield of 47,018 barrels.

International Petroleum Company's production rose 8 percent from 1954 to a total of 11,319,658 barrels last year, or a daily average yield of 31,013 barrels. Crude output of the company's Brea-Parinas field was stimulated by application of secondary recovery practices. In the zone north of Negritos, about 15,000 barrels of salt water were being pumped daily into the producing wells to increase the daily yield approximately 600 barrels a day.

From a total of 70 new wells completed by International during 1955, 31 were drilled for water injection programs. Fracturing applied to about 200 wells with negligible production has yielded good results.

For the first time, several new companies contributed to total Peruvian

Oil and Natural Gasoline Production in Peru

COMPANY	CRUDE OIL (in Barrels)				NATURAL GASOLINE (in Barrels)	
	Daily Average For Year 1955	Production For Year 1955	Daily Average For 1954	Production For Year 1954	Production For Year 1955	Production For Year 1954
International Petroleum Company*	31,013	11,319,658	31,426	11,470,487	898,836	938,446
Cia. Petrolera Lobitos*	13,600	4,964,099	13,130	4,792,388	175,066	168,488
Empresa Petrolera Fiscal	1,623	592,384	1,609	587,397	14,819	1,641
Cia. de Petroleo Ganso Azul Ltda.	719	262,413	853	311,253	.....	.....
Petrolera Peruana	196	71,529	.....	.....	.....	.....
Peruvian Pacific Petroleum Co.	53	19,261	.....	.....	.....	.....
Douglas Oil Company	44	16,190	.....	.....	.....	.....
Total	47,248	17,245,534	47,018	17,161,525	1,088,721	1,108,575

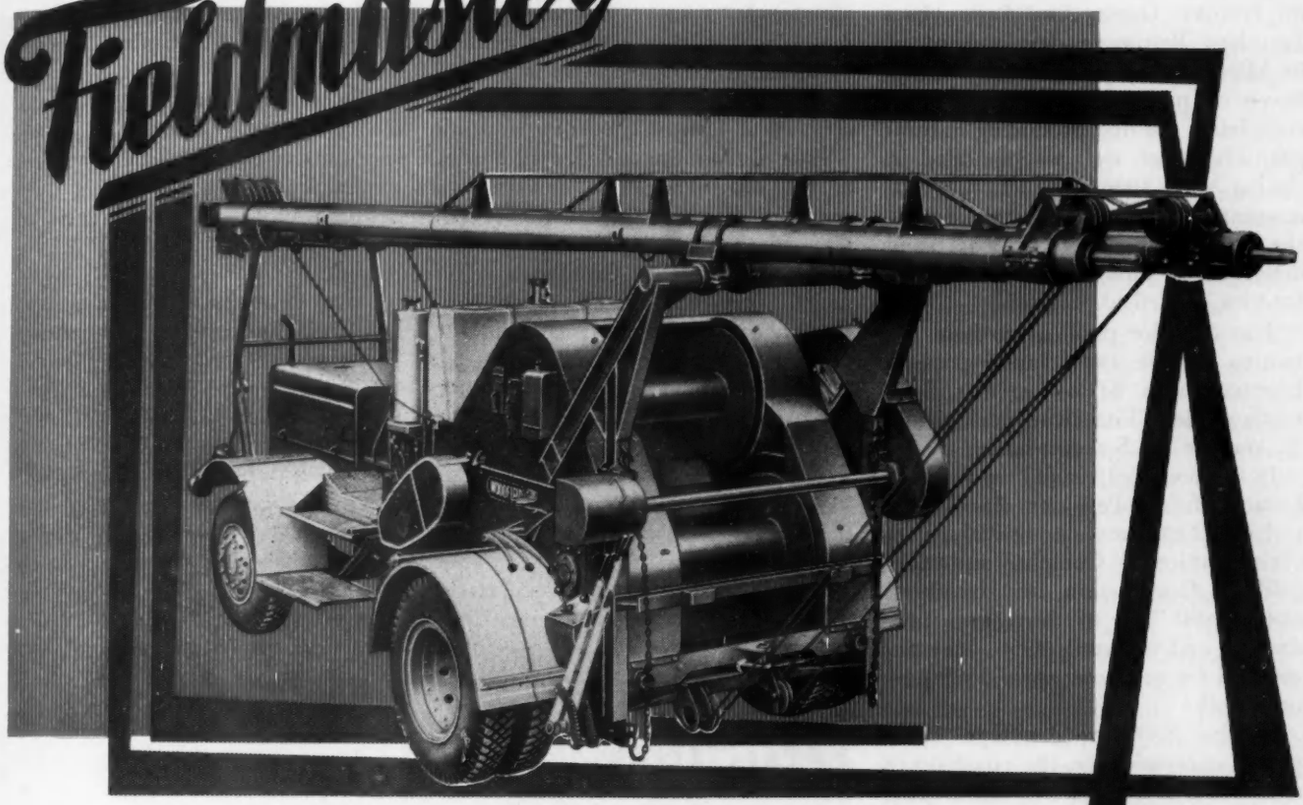
* Includes 50 percent share in joint operations areas.

Drilling in Peru

COMPANY	1955 WELL COMPLETIONS								WELLS COMPLETED IN 1954				
				Wildcats			Total						
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage	Oil	Gas	Dry	Total	Footage
International Petroleum Company	49	1	11	3	..	6	70	416,748	46	1	17	64	291,566
Cia. Petrolera Lobitos	81	..	24	..	..	..	105	386,597	72	1	23	96	359,487
Empresa Petrolera Fiscal	14	1	5	..	..	1	21	62,282†	20	..	9	29	91,249
Cia. Petroleo Ganso Azul Ltda.	....	..	1	..	..	2	3	3,077‡	5	..	..	5	8,847
Cia. Petrolera Peruana	4	1	0	..	..	..	5	n.a.	....	..	..	....	.....
Peruvian Pacific Petroleum Company	1	..	3	..	..	..	4	25,885	....	..	3	3	n.a.
Douglas Oil Company	....	..	4	..	..	..	4	n.a.	2	..	1	3	n.a.
Texas Petroleum Company	....	..	..	..	..	5	5	n.a.	....	..	..	....	.....
Oriente Company	....	..	..	..	..	1	1	n.a.	....	..	..	....	.....
International-Sea Oil	....	..	..	..	..	1	1	n.a.	....	..	..	....	.....
Total	149	3	48	3	..	16	219	894,589	145	2	53	200	751,149

† Does not include wildcat footage. ‡ Includes one well deepening project but does not include wildcat footage.

Fieldmaster



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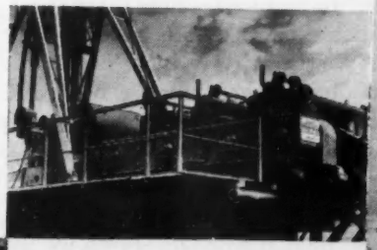
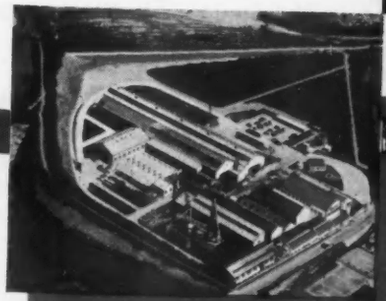
Ideco/Woodfield Hydrair H-525 Dual Rambler Rig with KM 105 Kwik Lift mast. Hook load 258,000 lbs.



Ideco/Woodfield Hydrair H40-D Double drum draw-works, with 3 A.E.C. Engines, 450 h.p., and four-shaft drive compound.

Rochester plant, which is constantly developing and enlarging its production and design capacities.



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crude production. In addition to International, Cia. Petrolera Lobitos, Empresa Petrolera Fiscal, and Cia. de Petroleo Ganso Azul Ltda., Cia. Petrolera Peruana's development of its Mirador pool proved encouraging. Seven oil producing wells have been completed, the first producing natural gas. The ninth well was spudded in during April, 1956. Production, which amounted to 71,529 barrels during the last months of 1955, was being delivered by pipe line to the nearby International field.

The Mirador pool, a southern extension of the Portachuelo pool of International's Brea-Parinas field, south of the Chira river, geologically lies outside the Sechura basin.

In the northern coastal area east of Lobitos' fields, Peruvian Pacific Petroleum Company, a subsidiary of Cities Service Oil Company and Richfield Oil Corporation, has completed eight wells. Two of them were producing, and in April, 1956, they accounted for total output of 5589 barrels of oil.

In the Petrolera Amotape Company's concession on the coast north of Lobitos, drilling and reconditioning of former producing wells was in preparation.

In Sechura, Texas Petroleum Company drilled three wildcats in its Peoco concessions which were acquired from Peruvian Oil Concessions, Inc., but they were dry holes. Only Peoco 7 discovered any oil shows, and they were negligible.

Sechura concession holders have reduced their holdings substantially, and no new activity was foreseen. International alone announced an intention of drilling any new wildcats, and Gulf Oil Corporation spudded its first wildcat near the Sechura coast in May.

Of the eight wells drilled offshore by Douglas Oil Company of California, only one was producing, and it accounted for 913 barrels in February, 1956. The company reportedly was planning to deepen one well before withdrawing from the area.

In eastern Peru's Montaña, Ganso Azul in April, 1956, spudded in Well 17. The company's production rate reportedly was fluctuating between 20,000 and 25,000 barrels per month. An exploratory test drilled in the Santa Clara dome was delayed by stuck pipe, but it was scheduled to be drilled ahead.

The 48-mile, 4-inch pipe line from the Montaña to Pucallpa was completed at a cost of $450,000 and opened in April, 1956. The line was scheduled to move oil which ultimately will reach the Manaos refinery in Brazil. Also, Ganso Azul is providing crude for the new government refinery at Iquitos.

East of Contamana, near the border of the Brazilian Shield, a German syndicate associated with the Peruvian El Oriente Company, spudded in its first wildcat—Cashiboya 1, on which work has recently been continued after difficulty with the hole was encountered.

The only important and decisive exploration in the Montaña was conducted by Texas Petroleum Company to define the possibility of an oil bearing sedimentary basin in the Maranon region. The first well at San Lorenzo, near Barranca bermeja on the upper Maranon river, reached a depth of 9787 feet when it encountered drilling difficulties.

The second well, about 140 miles downstream below the mouth of the Huallaga river, reached a depth of 9196 feet, but was flooded by the river in March, 1956, and had to be suspended.

Concession activity in the Montaña has been extremely lively, but mostly speculative. Acreage held by 15 companies amounts to about 33 million acres, described as the biggest concession area ever assembled in South America.

Texas Petroleum Company, a Mobil Oil Company affiliate, International, Richmond Oil Company, Peruvian Pacific, Cerro de Pasco, and Oriente Company each holds more than the former maximum of 2.471 million acres as a result of bidding conducted during an auction held from January to March, 1956.

Oil circles in Peru have expressed the general belief that the nation's oil future hinges on the successful development of prospects in the Montaña.

Uruguay . . . Trade pact with Bolivia signed. More exploratory drilling is forecast.

On Nov. 29, 1955, Uruguay and Bolivia signed a commercial pact and payments agreement to facilitate and expand trade between the two countries. The action called for initial trading of $500,000 and provided for periodic renewal.

The commercial pact was scheduled to be in effect for three years at which time it could be renewed. After the first year, the list of commodities may be changed because Bolivia may be able to export petroleum to Uruguay through a pipe line to the Paraguay river, thence downstream by barge to Uruguay.

Administracion Nacional de Combustibles Alcohol y Portland, the official government enterprise operates Uruguay's only refinery. The plant has a throughput capacity of 27,000 barrels daily and was operating at approximately 24,300 barrels a day of imported crude from Venezuela and the Middle East.

Average daily refinery yields amount to 27,275 barrels of gasoline; 3200 barrels of kerosine; and 3100 barrels of diesel and resid. Uruguay's domestic consumption is about 25,400 barrels daily and is increasing at an annual rate of approximately 8 percent.

ANCAP contracted with Dunlap & Graham of Los Angeles, Calif., to drill in the San Jacinto basin about 30 miles from Montevideo. Several oil showings were found there while local drillers were drilling for water —circumstances similar to those which occurred when Comodoro Rivadavia oil field was discovered in Argentina in 1907.

Dunlap and Graham sent a rig from Peru and drilled four wells under a contract which called for a total of six wells in about two years. The first four wells were dry holes, although the first recorded some oil shows.

Additionally, ANCAP scheduled three wells for the Santa Lucia area, where oil shows were encountered while drilling at about 3600 feet for water. Three other wells were scheduled for the northern region, where thick sedimentary beds are present. The contract provided that ANCAP could purchase the rig at any time, less depreciation.

Further drilling may be expected in Uruguay.

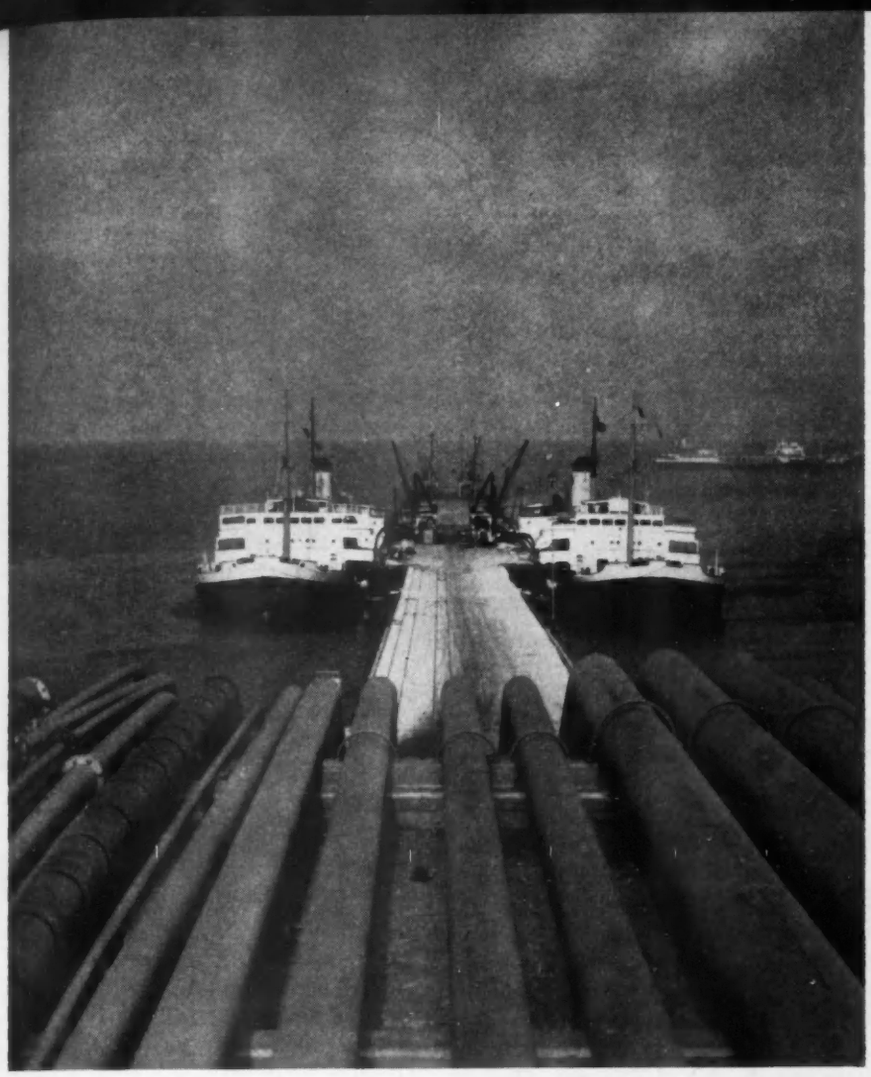


Photo courtesy Shell Petroleum Company Limited

Jetty No. 2 at loading docks of Compania Shell de Venezuela's Cardon installation on the Paraguana Peninsula, Venezuela.

Venezuela . . . First concessions granted in 12 years cover 197,680 acres in Lake Maracaibo area.

VIRTUALLY ALL PHASES of the oil business expanded in Venezuela in 1955 and 1956. In July, 1956, the Venezuelan government announced the first new concessions since 1945, as several companies operating in the country began to feel a definite pinch of declining production and a lack of productive and/or prospective acreage.

Crude production rose to 787,383,840 barrels in 1955, for an average of 2,157,216 barrels per day. This represented an increase of 260,539 barrels per day, or 13.74 percent, from 1954. Nine of the 14 operating companies showed an increase over the previous year, the other five showing a deficit, underscoring the need for new acreage.

Creole Petroleum Corporation, the nation's production leader, had the biggest volume increase with a boost of 158,654 barrels daily to 982,364 barrels per day, 19.26 percent above 1954. Texas Petroleum Company had the biggest percentage increase, up 17,242 barrels daily to 47,965 barrels daily, a 56.12 percent boost over 1954.

Sinclair Oil and Refining Company rose from ninth to seventh in the crude production by increasing production from 20,188 barrels daily in 1954 to 24,739 barrels per day in 1955, passing Venezuelan Atlantic Refining Company and S. A. Petrolera Las Mercedes, both of whose production declined last year. The most drastic decline occurred in the case of Coro Petroleum Company. Its daily production dropped from 525 barrels in 1953 to 484 in 1954, and to zero in October, 1955.

The Lake Maracaibo region continued to yield the bulk of the nation's crude output.

Concessions. As of Dec. 31, 1955, the total area covered by oil concessions in Venezuela was 14,507,656 acres, representing a 2.58 percent decrease from a year before. Venezuela's total prospective petroliferous area has been estimated at 86,485,000 acres, or 135,133 square miles, and only 16.8 percent of this estimated prospective area was under concession at the end of the year. The area covered by concessions at that time represented 6.4 percent of the total national territory (352,150 square miles).

Since no concessions had been granted since 1945, the Venezuelan government acted on many applications for concessions during 1956 and announced grants in July. The decisions followed requests for bids that had been going out intermittently since 1952, with several cycles of filing, refiling and postponements.

Early in 1956, the government announced the general terms under which grants would be made. Priority would be given, it was said, to concessions along Venezuela's boundaries, among other zones. Higher exploration taxes would be requested the first year, and there would be higher development taxes and royalties than was the case with previous grants.

Concessionaires would be obliged to refine a higher proportion of their crude production in Venezuela and to pay a higher differential royalty on Venezuelan crude refined in nonconsumer Caribbean localities outside the country. The companies would have to build open cities, not fenced-in camps, and to cooperate with the government in promoting industrial and agricultural development and other matters in the public interest.

The companies must cooperate with government agencies in the acquisition of radioactive isotopes and rare minerals associated with petroleum, though the concessions do not include development rights for nonhydrocarbon minerals.

Preliminary announcements of concessions granted concerned the northeastern Lake Maracaibo area, much

of the area being semi-proven, or at least, highly prospective. Eight blocks, totaling 197,680 acres went to the following companies; one to a syndicate composed of Hancock Oil Company, Signal Oil and Gas Company, and others; one to a Sun Oil Company-Atlantic Refining Company coalition; one to Compania Shell de Venezuela; one to Creole Petroleum Corporation; and four to Mene Grande Oil Company. Minimum bonus asked by the Venezuelan government reportedly was $1200 per hectare (2.461 acres).

In all, the government expressed the intention of granting between 4,922,000 acres and 7,383,000 acres. At one time, it was said that preference would be given to applications for the Barinas basin.

Drilling. Footage of wells completed in 1955 amounted to 6,541,819 feet, an increase of 516,281 feet or 8.57 percent above the previous year. Mene Grande Oil Company drilled more footage in completed wells during 1955 than any other operator in Venezuela, followed by Creole and Shell. Footage in the Barcelona area of eastern Venezuela exceeded the other three districts, including Maracaibo.

A total of 1163 wells were completed in Venezuela in 1955, of which 1026 were productive and 137 dry. This represents a big gain over 1954, when 836 wells were completed, 327 less than in 1955, and 115 less than in 1953, when 951 wells were drilled in the country. Shell completed 362 wells, Creole 229, and Mene Grande 196.

The producers included 680 inside locations, 270 extension wells, and 76 wildcats. Ten development wells, 32 extensions and 95 wildcats resulted in dry holes.

Reserves. Official government estimates put crude oil reserves at 12.5 billion barrels as of the end of 1955. The same source estimated that during 1955, reserves were increased by 1.5 billion after considering the amount of oil produced during the year.

Pipe Lines. In all, 138 miles of new oil pipe lines were installed in 1955. The longest was Shell's 47-mile, 16- and 24-inch crude line from Lagomar to Palmarejo on the northwest side of Lake Maracaibo, designed to move 170,000 barrels daily. Mene Grande Oil Company completed connections of Zeta, Nipa, and Soto oil fields in eastern Venezuela, about midway between Barcelona and Ciudad Bolivar, with a 44-mile, 16-inch line tying into Anaco pump station. The new system has a capacity of 80,000 barrels daily.

New gas lines constructed during 1955, none over nine miles in length, included 4 by Shell, 3 by Creole, and 1 by Mercedes.

Refining. A total of 195,841,347 barrels of crude oil was refined in Venezuela in 1955, for a daily average of 536,552 barrels. This represented an increase of 21 percent over the previous year, or significantly greater than the increase in crude production which was 13.74 percent above that for 1954. About 25 percent of current Venezuelan crude production is now being refined within the country.

A number of new pipe line projects have been announced in the past ten months. A 42-mile, 12-inch gas line between Guacara and Puerto Cabello was scheduled to commence construction in 1956. Williams Brothers of Tulsa, Okla., are under contract to Petrogas, S. A., of Caracas. One of the purposes of the line is to supply an 80,000-kilowatt steam power plant at Puerto Cabello with fuel.

Compania Shell de Venezuela, in the same report advising of the fourth distillation unit to be built at Cardon to boost refining capacity there to 270,000 barrels daily by the end of 1958, announced that a 177-mile, 20-inch gas line from La Paz oil field in the Maracaibo district, to the Cardon refinery, would be completed in 1957. The new line, when completed, will supply 106 Mmcf daily to the refinery, and gas will be the plant's primary fuel.

Perhaps the most important new line of all was announced April 30, 1956. Socony Mobil Oil Company and Sinclair Oil and Refining Company will build a 211-mile, 20-inch crude line from Silvestre oil field in western Venezuela, near Barinas, to Puerto Cabello.

The line initially will carry 100,000 barrels daily. Completion of the line will be a big and badly needed help to the Barinas basin, isolated as it is by the rugged Cordillera of Merida on the northwest and Venezuela's vast, undeveloped hinterlands in all directions except northeast, the course of the projected pipe line.

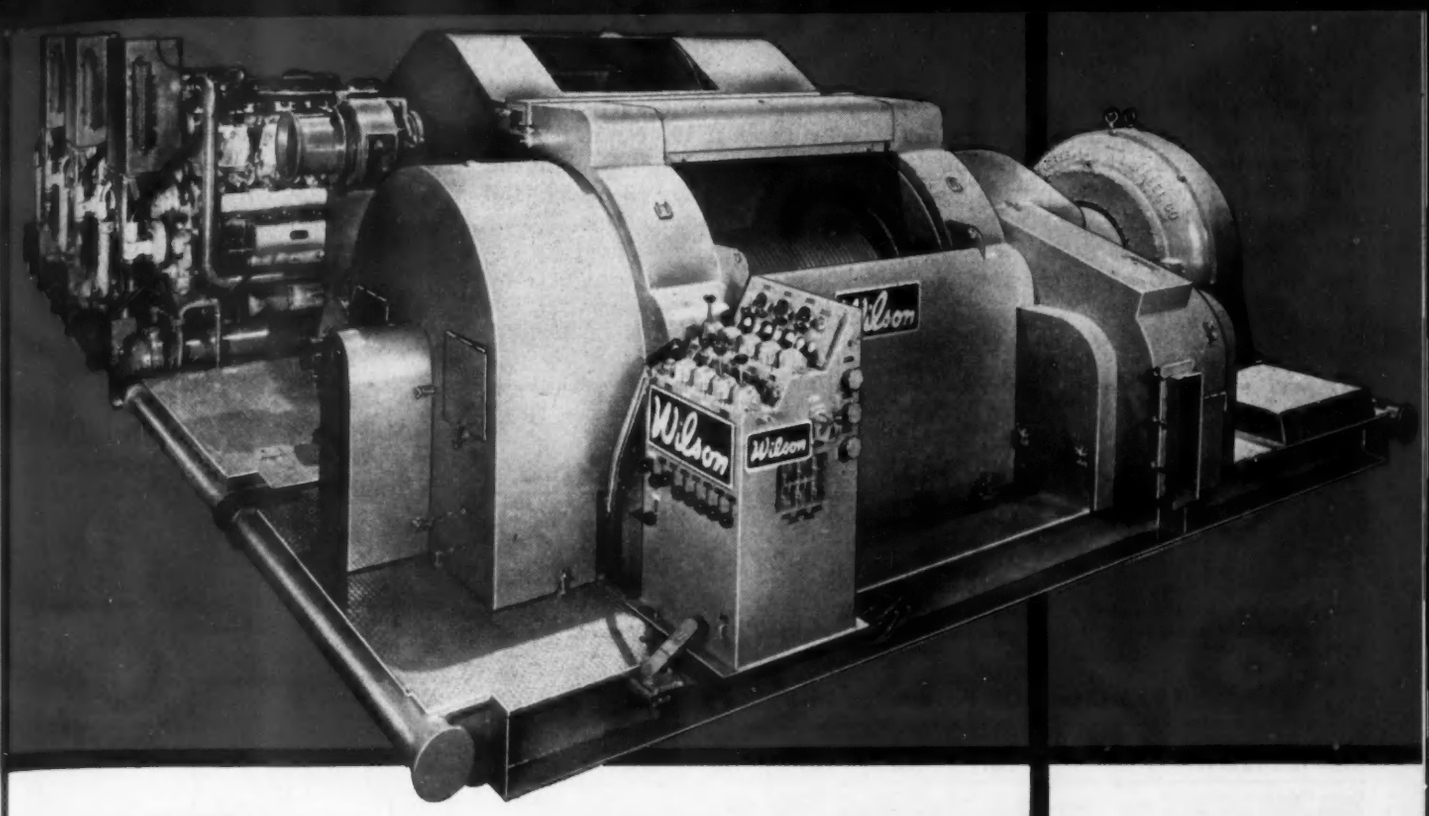
In May, 1953, a wildcat drilled by Venezuelan Petroleum, a Sinclair Oil Corporation subsidiary, found the first commercial oil in the Barinas basin. Three other wells were drilled to confirm the discovery, and all four, showing large potentials, proved an estimated 3500 acres, with at least a 66-million-barrel reserve being indicated. The field reportedly will be developed on 60-acre spacing, and may very well be the forerunner of many other big fields in the thus-far virtually untouched Barinas basin.

Creole Petroleum Corporation announced a record budget, $188 million, for 1956. Included was $7.6 million for two new crude pipe lines, one a 34-inch, 16-mile line from Bachaquero to Lagunillas, and the other a 28-inch, 94-mile crude line from Temblador to Caripito, the latter in far eastern Venezuela. A new pumping station also was planned for Lagunillas.

One of the functions of the Bachaquero-Lagunillas line will be to tie into the new supertanker loading terminals that Creole is building. A 120-acre artificial island terminal was being constructed off La Salina. Several million-barrel storage tanks were to be constructed, and the facilities will enable supertankers to load at the rate of 40,000 barrels an hour.

In mid-1956, the Venezuelan government was completing the dredging of the 35 feet deep, 46-mile channel from the Gulf of Venezuela into Lake Maracaibo to make deep water ports out of La Salina and Maracaibo. Formerly, Lake Maracaibo traffic was restricted to ships of from 13 to 18 feet of draft. The new channel, under construction since 1953, will help open up western Venezuela to world trade, both for imports of needed equipment and for export of oil.

Another striking aspect of the big 1956 Creole budget, however, was the allocation of $77 million, or 41 percent, to gas conservation and reservoir repressuring projects. Creole's first repressuring plant in Lake Maracaibo, Tia Juana 1, was completed in 1955 and proved very successful. There were minor vibration difficulties at first, but these troubles were ironed out, and the experience Creole



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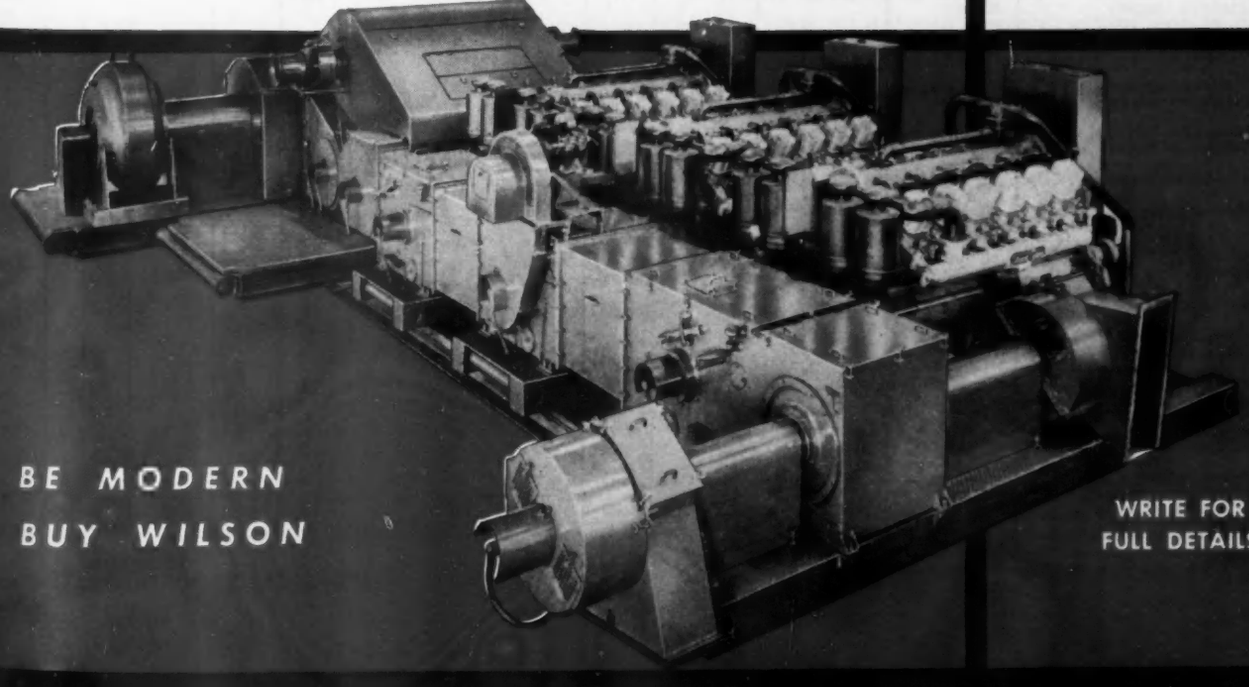

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has had with the big compressor station, built on pilings, has encouraged the company to enlarge its program. Tia Juana 2 was under construction at a cost of $31.2 million. Tia Juana 3, together with a gas gathering system was projected at a cost of $45 million. Eventually, it is possible that Creole will seek to repressure the pay sand in each major fault block in the Bolivar coastal fields in which the company has oil production.

In 1955, Venezuela raised its exports of crude oil and products by 12.8 percent from 1954 to a total of 738,630,000 barrels, or 2,024,000 barrels per day. The total crude oil exports were 590,815,000 barrels, or 1,620,000 barrels daily. The U. S., followed by Canada, Great Britain, and Brazil, were Venezuela's best oil customers. However, the rate of increase of exports to Europe was very high, up 30 percent from the previous year.

Total tax revenue from the oil industry collected by the Venezuelan government during 1955 was $500 million.

Drilling in Venezuela in 1955

(In Feet)

AREA	Footage of Wells Completed in 1955	Footage of Wells Suspended in 1955	Footage of Wells Drilling on December 31, 1955	Footage of Wells Redrilled in 1955	Total
Maracaibo	2,516,370	111,364	242,664	14,367	2,884,765
Barcelona	3,194,610	168,492	319,386	614	3,683,102
Maturin	719,745	26,965	45,475	.....	792,185
Batinas—Apure	111,094	12,431	2,526	.....	126,052
Total	6,541,819	319,252	610,051	14,981	7,486,103*

* Discrepancy of one foot in vertical and horizontal totals due to conversion of meters to feet with four-decimal conversion factor (3.2808 feet per meter).

1955 Crude Oil Production in Venezuela

NAME OF COMPANY	Year 1954	Daily 1954	Year 1955	Daily 1955	Change in Barrels	Change in Percent
Creole Petroleum Corporation	300,654,150	823,710	358,562,860	982,364	+158,654	+19.26%
Compania Shell de Venezuela	205,911,465	564,141	221,708,300	607,420	+ 43,279	+ 7.67%
Mene Grande Oil Company	106,655,555	292,207	115,607,180	316,732	+ 24,525	+ 8.39%
Socony Mobil Oil Company	24,144,020	66,148	25,553,285	70,009	+ 3,861	+ 5.84%
Texas Petroleum Company	11,213,895	30,723	17,507,225	47,965	+ 17,242	+56.12%
Richmond Exploration Company	12,567,680	34,432	16,458,580	45,092	+ 10,660	+30.95%
Sinclair Oil and Refining Company	7,368,620	20,188	9,029,735	24,739	+ 4,551	+22.54%
S. A. Petrolera Las Mercedes	9,060,395	24,823	8,895,050	24,370	— 453	— 1.83%
Venezuelan Atlantic Refining Company	7,539,440	20,656	7,196,705	19,717	— 939	— 4.55%
Phillips Petroleum Company	3,034,975	8,315	3,374,425	9,245	+ 930	+11.18%
Pantepec Oil Company	2,954,675	8,095	2,768,160	7,584	— 511	— 6.31%
Talon Petroleum Company	451,870	1,238	618,310	1,694	+ 456	+36.83%
Coro Petroleum Company	176,660	484	59,495	163	— 321	—66.32%
Caracas Petroleum Company	54,385	149	44,530	122	— 27	—18.12%
Total	691,787,785	1,896,677	787,383,840	2,157,216	+260,539	+13.74%

Footage Drilled in 1955 Well Completions in Venezuela

(By Company)

COMPANY	Drilling Footage in Wells Completed During 1955
Mene Grande Oil Company	1,523,495
Creole Petroleum Corporation	1,344,859
Compania Shell de Venezuela	1,336,870
Richmond Exploration Company	421,917
Socony Mobil Oil Company	413,279
Sinclair Oil and Refining Company	386,724
S. A. Petrolera Las Mercedes	312,946
Phillips Petroleum Company	255,837
Venezuelan Atlantic Refining Company	201,473
Texas Petroleum Company	193,613
Pantepec Oil Company	78,004
Colon Development Company	33,445
Talon Petroleum Company	15,594
Coro Petroleum Company	12,018
Caracas Petroleum Company	11,745
Total	6,541,819

Summary of Drilling Activities in Venezuela During 1955, by Company and Area

COMPANY	Area	COMPLETED WELLS				PRODUCTIVE WELLS				Dry Holes	Wells Drilling as of Dec. 31, 1955	Wells Suspended During 1955	Wells Recompleted During 1955
		Development Wells	Extension Wells	Wildcats	Total	Development Wells	Extension Wells	Wildcats	Total				
Creole Petroleum Corporation	Maracaibo	80	9	24	113	80	9	11	100	13	11	5	3
Creole Petroleum Corporation	Barcelona	9	54	16	79	9	48	9	66	13	5	10	..
Creole Petroleum Corporation	Maturin	24	4	9	37	24	4	1	29	8	6	5	..
Compania Shell De Venezuela	Maracaibo	323	23	6	352	322	21	5	348	4	20	5	5
Compania Shell De Venezuela	Barcelona	..	2	4	6	..	1	3	4	2	2	1	..
Compania Shell De Venezuela	Maturin	1	3	..	4	..	2	..	2	2	..	..	..
Colon Development Company	Maracaibo	8	..	1	9	8	..	..	8	1	5	3	..
Mene Grande Oil Company	Maracaibo	10	..	3	13	10	..	3	13	..	1	..	1
Mene Grande Oil Company	Barcelona	52	104	20	176	52	97	10	159	17	14	6	3
Mene Grande Oil Company	Maturin	..	3	4	7	..	3	2	5	2	1	..	..
Venezuelan Atlantic Refining Company	Barcelona	6	3	23	32	4	1	5	10	22	1	2	..
Venezuelan Atlantic Refining Company	Maturin	11	6	3	20	11	4	2	17	3	1	..	..
Texas Petroleum Company	Maracaibo	4	1	4	9	4	1	1	6	3	2	1	4
Texas Petroleum Company	Barcelona	7	7	6	20	7	4	2	13	7	5	..	..
S. A. Petrolera Las Mercedes	Barcelona	23	21	17	61	20	15	7	42	19	6	1	..
S. A. Petrolera Las Mercedes	Maturin	..	1	3	4	..	..	..	....	4	..	..	..
Caracas Petroleum Company	Barcelona	..	..	3	3	..	..	..	....	3	..	..	..
Coro Petroleum Company	Maracaibo	..	..	1	1	..	..	..	....	1	..	..	..
Sinclair Oil and Refining Company	Barcelona	5	..	..	5	4	..	..	4	1	..	..	..
Sinclair Oil and Refining Company	Maturin	25	..	8	33	24	..	5	29	4	3	..	..
Sinclair Oil and Refining Company	Barinas-Apure	..	..	10	10	..	..	5	5	5	1	..	..
Richmond Exploration Company	Maracaibo	41	13	..	54	40	13	..	53	1	3	1	..
Socony Mobil Oil Company	Barcelona	32	7	1	40	32	6	..	38	2	6	2	1
Socony Mobil Oil Company	Barinas-Apure	..	..	2	2	..	..	2	2	..	..	1	..
Pantepec Oil Company	Barcelona	5	1	..	6	5	1	..	6	..	1	..	..
Pantepec Oil Company	Maturin	2	2	..	4	2	2	..	4	..	..	..	..
Phillips Petroleum Company	Barcelona	7	17	3	27	7	17	3	27	..	2	5	..
Phillips Petroleum Company	Maturin	15	8	..	23	15	8	..	23	..	1	1	..
Talon Petroleum Company	Maracaibo	..	13	..	13	..	13	..	13	..	..	5	..
Grand Total	.....	690	302	171	1,163	680	270	76	1,026	137	97	54	17

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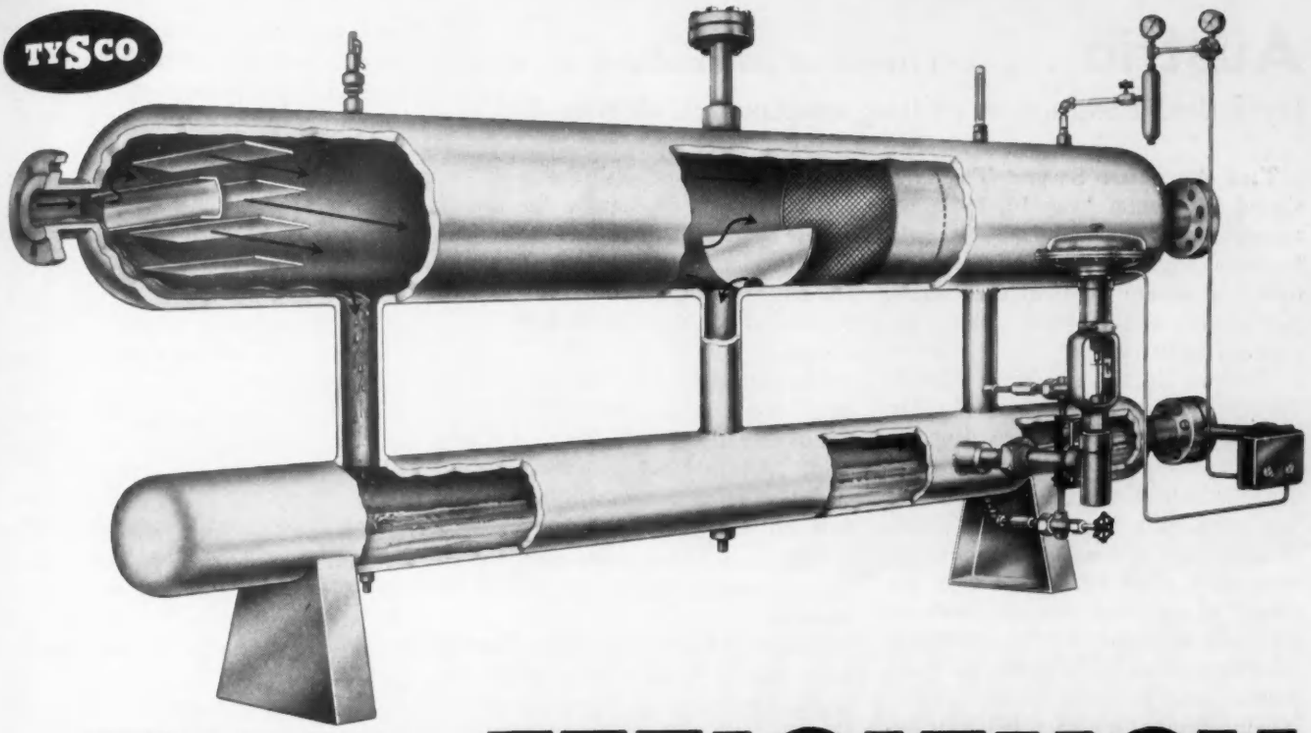

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Austria . . . Threat of nationalized oil industry fades. Production drilling emphasized during 1955.

THE AUSTRIAN STATE TREATY, signed in Vienna May 15, 1955, returned to Austria all Soviet-held business enterprises. But it has resulted in severe political difficulties, particularly affecting the nation's petroleum industry.

German influence from March, 1938, to April, 1945, and Russian control from May, 1945, to Aug. 13, 1955, entirely changed the prewar organization of the oil business. The formation and organizational charts of companies, the concessions and development since 1938 have been the center of political struggle both on the international level—concerning reimbursements to Western oil companies—and on the domestic level—hinging around a choice between nationalization or public enterprise.

The May 13, 1956, elections answered most of these questions around which heated debates circulated last year. The Vienna Memorandum will be fulfilled by Austria, though the form of settlement remained unknown since Western firms had not yet submitted any claims of losses.

The future organizational form of the Austrian oil industry—which was being managed through a team of four public administrators—may be comprised of all ex-Soviet exploration, development, refining and pipe line companies. On May 13, 1956, the Austrian Peoples' Party (Conservative) won 82 seats in the Lower House of Parliament, defeating the Socialist Party, which won 75 seats; the nationalistic Freedom Party, with 5 seats; and the Communist Party, 3 seats.

Immediately after the election results were announced, Chancellor Julius Raab, of the Peoples' Party said: "All that we promised during the election campaign will be actually fulfilled in the near future."

The party had actively campaigned against nationalization of the oil industry.

Finance Minister Reinhard Kamitz later said: "The election result has pointed out that an expansion of nationalization will not be made under any circumstances. New ways must be worked out to secure for the entire population participation of property in enterprises whether they are nationalized or private."

Anticipated results of the Peoples' Party victory included:

- A demand that the Ministry of Communications and Nationalized Industries be divided into independent ministries and that the nationalized industry department be ruled by a Peoples' Party appointee.
- An immediate revision of the oil industry whereby 51 percent ownership of shares by the state and 49 percent public stock subscription will be effected. Final decisions on the oil questions and presentation of specific oil laws was expected to be made late in 1956.
- Restoration of operating privileges to two Western oil companies—Mobil Oil of Austria and Shell of Austria. Claims of both companies concerning East Austrian rights, taken from them during 1938 and 1945, will be subjects of conferences later this year.
- Action that will prevent outright nationalization of the Austrian oil industry.

Drilling. The Austrian Mineral Oil Administration drilled 113 wells in 1955, as compared to an estimated 79 wells completed in 1954, when Russia still operated Austrian oil fields.

AMOA emphasized production drilling during 1955 owing to the increased demands by Russians through the Austrian State Treaty compensatory deliveries of crude to the Soviet Union. Exploration drilling was expected to increase during 1956, with development drilling remaining at the 1955 level.

The rapid drop in natural gas well drilling resulted from AMOA's intention of first getting under control the natural gas wasted by the Soviets during the past ten years from wells already drilled. With gas losses amounting to 98,868 Mmcf during August, 1955, extensive work reduced losses to about 41,313 Mmcf during February, 1956.

Non-AMOA companies—Rohoel Gewinnungs Gesellschaft (RAG) of Vienna and Van Sickle Company also conducted drilling operations during 1955 but on a smaller scale than AMOA. Both RAG and Van Sickle drilled successful wells outside the producing area.

RAG drilled in Upper Austria while Van Sickle conducted its drilling operation in Styria province.

Footage drilled last year amounted to 8753 feet for Van Sickle and to

Austrian Crude and Natural Gas Production

COMPANY	FIELD	Crude Production in 1955 (Barrels)	Natural Gas Production in 1955 (in million cubic feet)
Austrian Mineral Oil Administration	Muehlberg	2,242,307	1,653
Austrian Mineral Oil Administration	Neusiedel/Zaya	700,318	857
Austrian Mineral Oil Administration	Matzen, Auersthal and Bockfliess	19,502,895	8,044
AMOA and Erdoel Produktions Gesellschaft	Goesting	291,382	86
Rohoelgewinnungs-gesellschaft	Gaiselberg	713,928	162
Van Sickle Company	Neusiedel/Zaya	235,720	146
AMOA	Aderklaa	.....	1,056
AMOA	Erdgasgesellschaft	.....	15,052
.....	Others*	1,199,018	.....
	Total	24,885,568	27,056

* Not classified as to company or field.

Drilling in Austria by Austrian Mineral Oil Administration

NUMBER OF WELLS COMPLETED						Number of Wildcats Completed		Number of New Wells Put Into Operation at End of Year		FOOTAGE DRILLED					
Oil		Gas		Dry						Development Drilling		Wildcat Drilling		Total Drilling	
1955	1954	1955	1954	1955	1954	1955	1954	1955	1954	1955	1954	1955	1954	1955	1954
113	79	4	12	6	17	20	30	16	19	480,569	375,135	103,779	167,702	584,348	542,837

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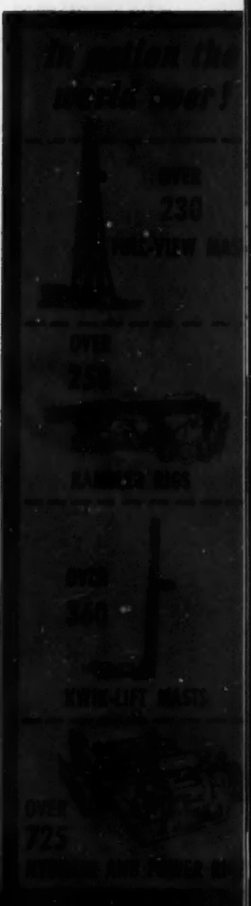

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19,567 feet for RAG. Van Sickle completed one oil producer and one exploration well (Perbersdorf 1), and RAG completed one producing well and was continuing work on two wildcats in Upper Austria.

Production. Crude production during 1955 totaled 24,885,568 barrels of which AMOA accounted for about 23,622,240 barrels—a daily average rate of 64,718 barrels. The remainder was supplied by the two independent companies. In all references, the 50 percent share of the third independent development company, Erdoel Produktions Gesellschaft, has been added to the AMOA group.

Total production from Austria's fields, through 1955, amounted to 175,630,092 barrels.

Exploration. Russia stopped exploration operations in the east during the first half of 1955 when it became apparent that it had decided to conclude the Austrian State Treaty. The accelerated activities of AMOA conducted after Russia relinquished its controls on Aug. 13, 1955, could not balance the lack of work done during the first seven and a half months.

Oil exploration operations centered in the Ravensburg area and natural gas exploration near Schwadorf. AMOA was continuing exploration operations, primarily with seismic parties, since geological mapping of the East Austria oil area has been practically completed.

During the period from 1945 to March, 1956, after geological mapping, RAG drilled 4966 seismic detonation holes for total footage of 427,225 feet, and 89 structural wells, with footage totaling 66,102 feet, in the Puchkirchen area and the Bath Hall area of Upper Austria province. The first deep well reached a depth of 9023 feet at Puchkirchen on April 10, 1956—Austria's deepest well to date—at which point basement was hit. Only oil and gas traces were found in the hole, but perforation work was under way at mid year. The Bath Hall well drilled into the Upper Oligocene horizon of the Molasse basin at 2967 feet on April 10, 1956.

Van Sickle Company drilled its Perbersdorf 1 in 1953-1954, but after reaching 4846 feet, the Molasse bottom was reached without any oil or gas shows.

New Field Discovery. Ravensburg produced its first oil early in 1955. This four-well field has an average depth of 4560 feet, and last year produced 7500 barrels. Drilling and exploration efforts were continuing.

Concessions. Conclusion of the Austrian State Treaty brought a distinct change in concession matters. The so-called Scientific Research Order issued to interested oil companies by the State Geological Institute (used as a by-pass so as not to have to issue concessions when the SMOA was asking for concession awards) ceased to exist. Instead, the Bitumen Law was applied to granting a four-area concession to RAG.

The Federal Ministry's Supreme Montan Authority said that, as of May 1, 1956, a total of 15 concession applications had been filed. These applications cover about 7720 square miles of such areas in which concessions were issued either before World War II or during the war. No further concessions were expected to be granted to the Austrian and U. S. firms who applied before the election.

The Federal Trade Ministry maintains the viewpoint that all German concessions became void when the German Reich collapsed April 27, 1945, and that the Soviets operated the German Assets in Austria without legal title to such concessions.

In contrast, the Federal Ministry of Communications and Nationalized Industry (supreme authority of the AMOA) maintains that titles are inseparable from the assets.

With the outcome of the May 13 election this year, the Federal Trade Ministry position was maintained.

General Economics. Increased interest in oil and gas has been evidenced by formation of a provincial oil exploration and production company in Vorarlberg province, whereas the Upper Austria province has expressed high interest in its oil and gas resources, principally to bring inexpensive local fuel to industrial centers.

AMOA is subordinate to the Federal Ministry of Finance insofar as investments and taxation, to the Federal Ministry of Nationalized Industry as to actual conducting of business and to the Federal Ministry of Trade on mining aspects of operations. Thus AMOA has been merely the offices of the four public administrators.

RAG and Van Sickle both are nationalized but under the old management. They are not subordinate to the FMNI.

AMOA announced its 1956 investment program of March 14, 1956, to include expenditures of $16,154,000 for the calendar year. Of this sum, $4,346,000 for refitting and modernization; $5 million for the drilling of 90 field wells; $1,538,000 for 12 to 14 exploratory tests; $2,308,000 for oil area road construction and $692,000 for transportation department modernization.

Imports and Exports. Austria's crude production would more than fulfill domestic requirements—thus permitting relatively large exports—if reparational deliveries to Russia were not depriving the nation of about 76 million barrels for a 10-year period.

Denmark . . . Standard Oil interests seek agreement to take over Gulf concessions.

DANISH AMERICAN PROSPECTING COMPANY (DAPCO) has not succeeded in finding oil in Denmark, and negotiations were under way between Gulf Oil Corporation, DAPCO's parent company, the Danish Government, and Standard Oil Company (New Jersey) to transfer the concession from Gulf to Standard interests.

Provided a satisfactory arrangement can be consummated, Standard interests will take over oil exploration in Denmark. Tax problems present the main aspect still to be settled.

DAPCO entered Denmark in mid-1950 when it received a 50-year concession, qualified on a discovery being made in the first ten years. Since then, DAPCO has drilled three deep tests below 10,000 feet to the base of the Permian, without success.

Operations were suspended in 1954 and were being resumed in early 1956, with shallow core drilling to 600 feet being done north of Copenhagen on Sjaeland Island.

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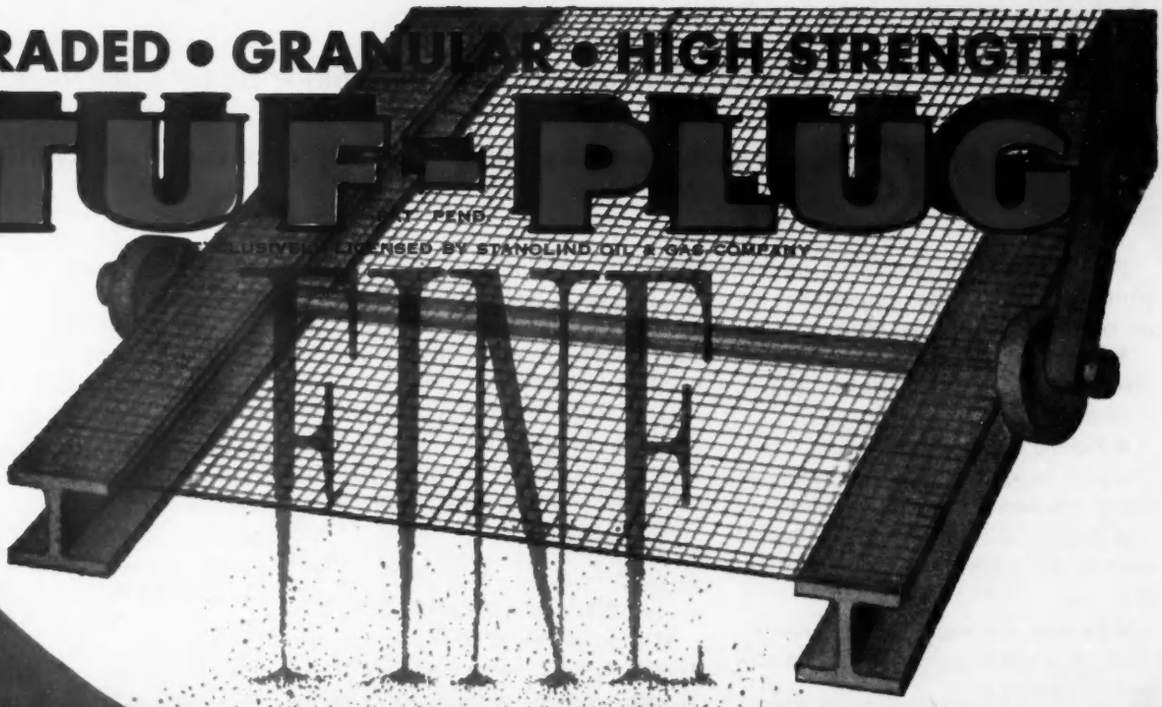

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France . . . Development of Parentis into major reserve and new fields push production up 78.5%. Oil codes are clarified. Refinery expansion underway.

FOUR MAJOR developments underscored France's rising importance as an oil-producer during 1955:

- Esso REP's Parentis field, discovered in 1954, developed into a major reserve.
- France's petroleum codes were clarified in detail, and resolution of many concession requests was effected.
- Two new oil fields were discovered in the Rhine graben area of Alsace.
- France, charging her refineries almost to capacity, had a sizable expansion under way.

Societe Esso de Recherches at d'Exploitation Petrolieres (Esso REP) was formed in May, 1954, to develop Esso Standard SAF's Parentis field in the Aquitaine basin in southwestern France. Esso REP is owned 89 percent by Esso Standard SAF (63.2 percent Jersey Standard, 18.349 percent Gulf Oil Corporation, and 18.451 percent French investors) 10 percent by the French government, through its Bureau de Recherches du Petrole (BRP) and 1 percent by FINAREP, a French company holding minority interests in 13 other French oil companies.

During 1955, Esso REP produced 4,267,300 barrels from Parentis field (11,700 barrels per day) and a total of 81,908 barrels from Mothes, a mid-1955 oil discovery located seven miles east-northeast of Parentis. Production from Parentis comprised two-thirds of the nation's 1955 total crude production of 6,408,508 or 17,557 barrels per day. France's older fields, Lacq, Gallician, Staffelfelden and Pechelbronn declined sharply during 1955.

The Aquitaine basin, with a total 1955 crude production of 5,975,940 barrels was the leader among France's petroliferous provinces, with 93.4 percent of its oil yield. The Rhine Graben, with 387,900 barrels, had 6.2 percent, with the Languedoc basin, bordering the Mediterranean sea east of Marseilles, represented only four-tenths of one percent of the total.

Drilling footage again rose in 1955 to 439,975 feet, almost 44 percent more than 1954's 308,760 feet and almost 65 percent in excess of 1953's 267,100 feet. Six companies participated in active exploration drilling. There were 26 active rigs, 12 of them rated to 12,000 feet or deeper.

Esso REP completed 9 wells at Parentis, 8 oil wells and 1 dry hole. There were 12 producing wells at the end of 1955 and 3 edge wells shut in. Parentis production is from Neocomian (lower Cretaceous and upper Jurassic) dolomite and limestone between 7200 feet and 8600 feet.

Maximum height of the oil column is 1500 feet. Many of the wells drilled to date are flank wells, with many inside locations, mainly in Lake Biscarrosse, yet to be drilled. Production is steadily rising. It was 14,000 barrels daily in October, 1955, and by March, 1956, Parentis production had reached 19,000 barrels daily. The field now measures seven miles along its east-west structural axis, and is about two miles wide.

Permeabilities in the dolomite horizon are good, and the bottom hole pressures, about 3400 pounds per square inch have equalized nicely. The producers generally make from 1000 to 3000 barrels daily of 33.5 gravity oil. The gas-oil ratios are about 30 to 1, and an effective water drive is apparent. Parentis unquestionably represents a major reserve.

Mothes. Mothes 1, a wildcat completed in mid-1955 for 365 barrels of 20.5 gravity oil on pump, after acidizing, produces from limestone, equivalent to the Parentis pay, at 7700 feet. However, Mothes is separated by well established faulting from Parentis field. Mothes 2, a short distance northeast of the discovery well, is either a very light producer or a dry hole. All other known data indicate Mothes to be a minor field.

As a result of disappointing exploration results in the northern part of its Bordeaux concession, Esso relinquished 400,000 hectares (988,400 acres) of its surface holdings, effective Feb. 1, 1956. Mobiloil SAF filed application to acquire some of the same acreage Esso dropped. From wildcats drilled to date, it appears that the Parentis pay formation may be absent north of Bordeaux.

Lacq. Societe Nationale des Petroles d'Aquitaine (SNPA) drilled two extensions to the Neocomian limestone gas horizon equivalent to the oil pay at Parentis, they were Wells 105 and 106, and the latter was drilling at the end of 1955. This gas pay lies below 10,600 feet. Special anti-corrosive tubing was tested in Lacq 102 and showed that it is feasible to produce this highly sulfurous gas.

Early in 1956, SNPA began construction of a plant to purify the gas. It will have a daily natural gas throughput capacity of 35.3 Mmcf. The plant, when completed during the first half of 1957, will produce annually an estimated 55,000 tons of sulfur, 8000 tons of propane and butane, and 11,000 tons of gasoline.

The extent of the deep gas reserves at Lacq, though considerable, is unknown. SNPA has staked locations for two long northwest stepout wells, Lacq 113 and Lacq 122.

In the shallow Lacq field, one rig was occupied with development well drilling and workovers. Twenty-five wells were producing at the end of 1955, 11 pumping and 14 flowing.

St. Marcet. No wells were drilled in this old gas field, east of Lacq along the north rim of the Pyrenees, and production remained essentially constant.

Paris Basin. Five dry holes drilled by Regie Autonome des Petroles (RAP)

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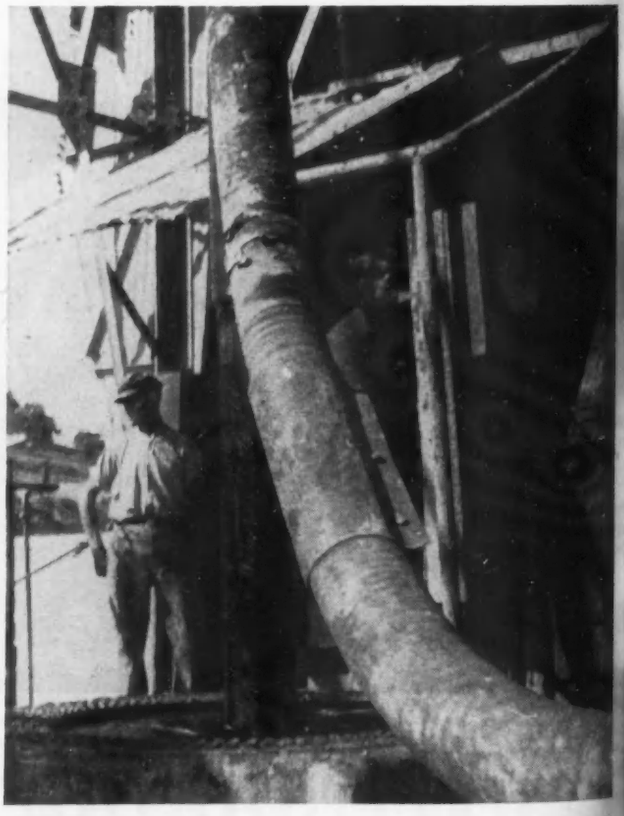
Rigs at work dot French countryside . . .

In the foreground of this view of the St. Marcet anticline in France is a gas collecting station. In the background is the drilling rig at the site of St. Marcet 19.

Drilling is ready to get underway at this St. Marcet rig.



French driller, right, and crew member are watchful as they drill ahead at Proupiary 3 well.

Here's Why COLUMBIAN BOLTED STEEL TANKS "Just Fit Up Better"

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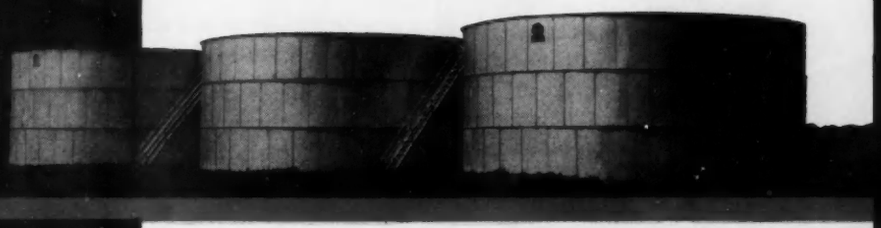
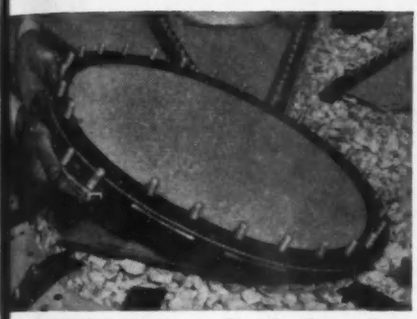
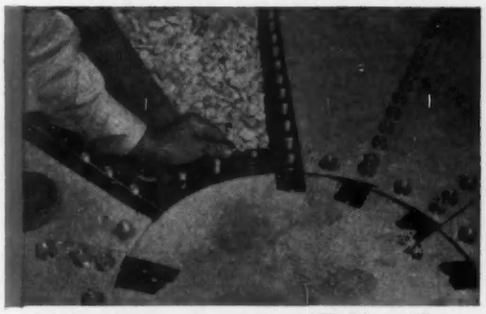




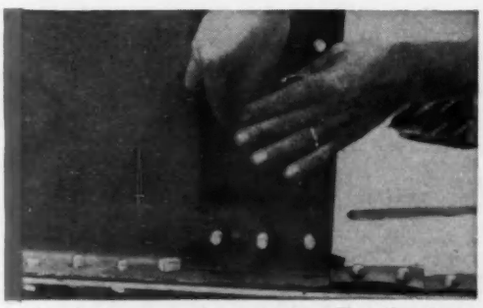
"Rubbering" the bottom: Synthetic gasket material is applied to center plate of Columbian tank bottom. Note short channel lengths for holding bolt heads.



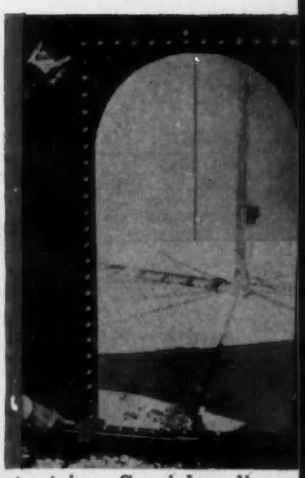
Joining bottom segments: "Rubbered" on one edge and bolted to adjoining segments. Special wedge-shaped gaskets are provided for three-thickness (2 segments and center plate) joints.

Tight-Sealed bolt holes: Steel backed Neoprene washers are provided for all side and bottom seams. As bolts are tightened cup-shaped steel washers press rubber washers tight in and around bolt holes, forming a perfect, leak-proof seal.

Leak-proof Side-Bottom seam: The special wedge-shaped gasket is used for joints of 3 thicknesses (bottom and lap of 2 staves). To prevent any possible leak at flange radius, a special radius gasket—a Columbian extra—is inserted under stave's strip gasket.



Special Large-tank protection: For the double or triple bolt rows on large-capacity tanks, Columbian provides not only strip gaskets for each row but the special radius gaskets to span each row of holes.



No leak out at cleanout: Cover (either flat or extended) for cleanout is sealed tightly to stave. Strip gaskets extend beyond corner bolts with tank cement under laps of side and top gasket strips. Special radius gaskets are used under side strip gaskets at bottom flange.

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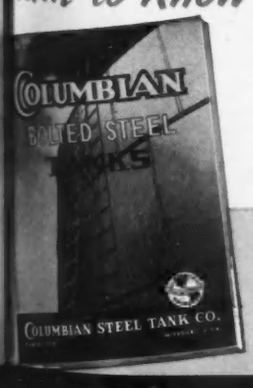

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on the Bray anticline between Paris and Dieppe seemed to confirm that the small production found here in 1954 is non-commercial.

Jura. The Bureau de Recherches Geologiques Geophysiques et Minieres drilled three shallow Triassic tests between 2100 feet and 2700 feet, without developing commercial production that their 1954 oil discovery at Briod had indicated.

Alsace. Two new fields were discovered, apparently in stratigraphic traps in Jurassic beds. Societe de Prospection et Exploitation Petroliere en Alsace (PREPA) completed eight oil wells at about 1600 feet of depth in the new Donau field, near the German border. Encroaching water already was a problem.

In southern Alsace, PREPA Reiningue 1, drilled to 4700 feet, came in as a Jurassic oil discovery late in 1955. A dry hole, Staffelfelden 9, was completed three miles north of the discovery at a depth of 8300 feet.

Geophysical activity was brisk in 1955.

The Aquitaine basin and Rhine graben were primary areas of geophysical activity, but operations were not restricted to onshore areas. Esso carried on a three-month seismic program to evaluate its holdings seaward from the Bordeaux concession. Esso's permit area extends into the Atlantic Ocean from a minimum of 1½ to a maximum of 12 miles offshore.

Geophysical Activity in France During 1955
(Party Months)

COMPANY	SEISMIC		Gravity	Magnetic	Telluric and Electric
	Refraction	Reflection			
SNPA	0	67.5	0.5	0.7	18.3
RAP	0	24	0	0	0
SPG	0	24	0	0	0
Esso REP	0	56	0	0	0
CEP	10.5	6	8.5	1.5	0
PREPA	0	24	0	1	0
Total party —months	10.5	201.5	9	3.2	18.3

Clarification of Laws. France continued its recent policy of encouraging oil exploration as part of a coordinated effort to improve the national economy. Two sets of decrees were issued in 1955, modifying the 1927 law concerning mining development permits and the law of 1810 concerning exploration and development of mineral substances.

The May, 1955, decrees set a limit on the duration of development permits—15 years. The Ministry of Industry and Commerce Decrees of August and October covered public administration regulations of exclusive permits for oil and gas exploration, development permits and concessions. Exact procedures for filing and processing applications were formulated. Government royalty rates on production were set by the October 14 decree, as follows:

Rates	Percentage of Value or of Production of Crude
For a part of production of under 50,000 tons* per year	0
For that portion of production between 50,000 and 100,000 tons per year	6
Between 100,000 and 300,000 tons per year	9
Between 300,000 and 1 million tons per year	12
Over 1 million tons per year	14

* 1 ton = 6.965 barrels.

Royalty rates on crude are adjusted to decline where transportation distances increase.

Royalty on gas production is zero until it reaches the rate of more than 10 billion cubic feet annually. Then the royalty is 5 percent. In the event a concession produces both oil and gas, the shares resulting from application of the two adjustable scales shall be cumulative.

This clarification of French oil policies has had a prompt beneficial effect on the number of exploration permits applied for and granted. FROPEX (Societe France Outre-Mer de Prospection et D'Exploitation Petroliere; Caltex and French interests) has 7800 square miles in four concessions in the Paris basin; RAP had an extensive concession area extending from Melun, 40 miles southeast of Paris, to Metz, 156 miles east-northeast of Melun, and another big permit area in the Rhone Valley north of Lyon. By the end of 1955, more than 50 exploration permits had been applied for in France, with over 30 companies participating. French, U. S., British, Dutch, and Italian interests were all involved in exploration activity.

ACKNOWLEDGMENT

Sources of some of the data used herein are the *Bulletin of the American Association of Petroleum Geologists*, and *Le Journal des Carburants*.

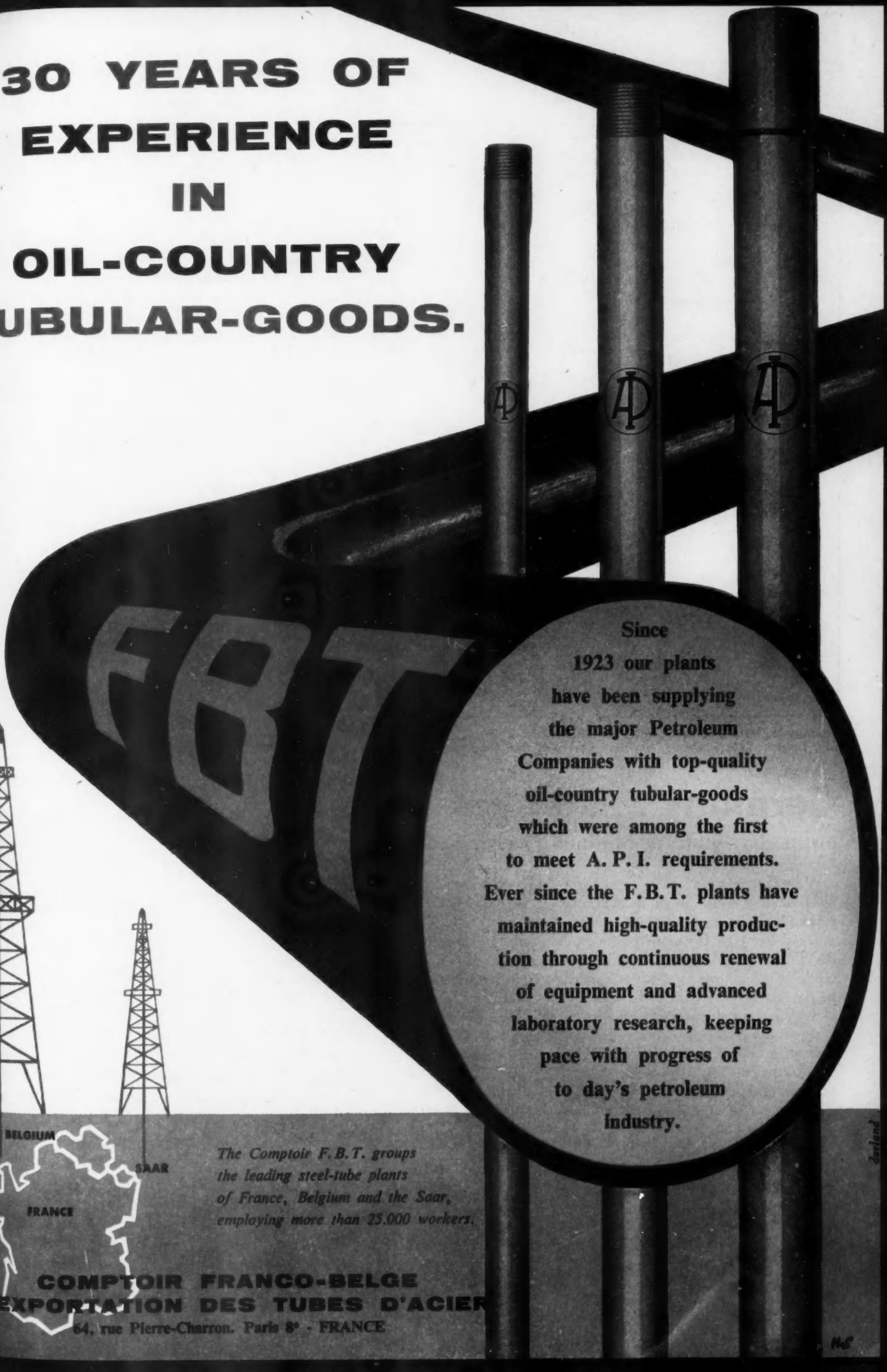
Production in France in 1955

FIELD	Ownership	Basin	Crude Production in 1955 (Barrels)	Crude Production in 1954 (Barrels)	Percent Increase or Decrease 1955
Parentis	Esso Standard SAF	Aquitaine	4,267,300	982,640	+ 329%
Lacq	SNPA	Aquitaine	1,669,000	2,069,600	— 19.3%
Pechelbronn	Pechelbronn	Rhine Graben	284,000	318,000	— 10.7%
Donau, Schirein, Reiningen	PREPA	Rhine Graben	59,000	0	.....
Staffelfelden	PREPA	Rhine Graben	44,900	216,300	— 80%
Mothes	Esso Standard SAF	Aquitaine	81,908	0	.....
Gallician	CEP	Languedoc	2,400	4,120	— 72%
Total	.....	.....	6,408,508	3,590,660	+ 78.5%

Drilling in France in 1955

COMPANY	Number Heavy Rigs	Number Medium Rigs	Number Shallow Rigs	Footage Drilled During 1955	FIELD	Field Wells Completed in 1955				Wells Drilling at Dec. 31, 1955	Wildcat Wells Completed in 1955				Wildcat Wells Drilling at Dec. 31, 1955
						Number Completed	Oil	Gas	Dry		Oil	Gas	Dry	Total	
Esso REP	3	2	0	140,820	Parentis Mothes	9 3	8 1	0 0	1 2	2 0	1 ..	0 ..	6 ..	7 ..	2 ..
SNPA	5	1	3	118,200	Upper Lacq Lower Lacq	9 1	9 0	0 1	0 0	0 2	0 ..	0 ..	9 ..	9 ..	7 ..
PREPA	0	2	1	78,525	Donau Staffelfelden	13 1	8 0	0 0	5 1	0 0	2 ..	0 ..	17 ..	19 ..	2 ..
RAP	2	0	1	48,300	St. Marcet	0	0	0	0	0	0	0	15	15	1
CEP	0	2	1	35,700	Gallician	0	0	0	0	0	0	0	6	6	3
Total	10	7	6	439,975	.....	36	26	1	9	4	3	0	53	56	15

30 YEARS OF EXPERIENCE IN OIL-COUNTRY TUBULAR-GOODS.



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Expansion of Germany's natural gas production stemmed from development of the Rehden field, near Diepholz, and Stockstadt and Eich gas fields near Darmstadt, in the upper Rhine valley.

Germany . . . Oil industry enjoys growing prosperity. State to continue receiving royalties.

A SIGNIFICANTLY high operating level of the oil industry bolstered a generally growing prosperity which marked Western Germany's economy in 1955 and 1956. Industry and trade circles were supported by Parliament in an effort to reduce the current heavy tax burden; however, the move was retarded by Finance Minister Schaeffer, who has expressed fears of a fiscal deficit. With full employment, trained manpower is becoming more difficult to find, and wages are on the rise.

For the petroleum industry, a recent high court decision is of signal importance. Under its ruling, legality of the Bitumen Law and the Prussian Oil Decree of 1934 has been confirmed. This means that all claims by private land owners for royalties are denied. Since 1934 the state has been granting concessions and receiving royalties.

Crude producers had protested against the intention of eventually granting separate concessions for the search for underground natural gas storage reservoirs. Behind their protests was the belief that such a privilege was identified with the rights granted in oil and gas development concessions.

The new Traffic Finance Bill, valid from May 1, 1955, brought an increase in petroleum taxation which, incidentally, did not essentially lower the upward trend of fuel consumption.

Drilling. The scheduled drilling goal in 1955—2.6 million feet—was not reached. Actual footage drilled during the year amounted to 2,409,140 feet, or 11.3 percent more than the figure for the preceding year.

Germany continued its intensified search for oil with the help of 132 rotary rigs and 98 lighter drilling units. In comparison to international standards and to relatively low current crude production, footage drilled last year was extraordinarily high, as it has been for years.

About 40 percent of the 1955 footage was credited to exploration wells, i.e., footage of 577,581 feet was drilled by wildcats and 390,552 feet was drilled by extension wells. An additional 75,857 feet was recorded by service wells for secondary recovery purposes.

Of the 567 wells completed in 1955, 384 wells found oil or natural gas. Of the wildcats, 15 completions discovered oil or gas and 92 were dry holes. Thirty of 77 extension wells encountered oil or gas horizons.

At the close of 1955, a total of 2808 oil wells and 27 natural gas wells were producing with an average crude production total of 22 barrels per well per day.

Production. Western Germany last year increased its crude production by 18 percent to 22,345,219 barrels for a daily average output of 61,220 barrels. On an annual basis, that is equal to about 3.4 million barrels more than the 1954 yield.

Some new discoveries and increasing production from old fields contributed to this rise. Positive results were achieved in some older fields by application of secondary recovery practices, by fracturing and by chemical treatment of the pay zones. Hanover and Weser-Ems districts led in the rate of production increase.

Oil fields and their share of total production in 1955 are:

Emsland, 35.7 percent; Hanover, 35.5 percent; Weser-Ems, 14.7 percent; Holstein-Hamburg, 11.1 percent, Upper Rhine Valley, 2.6 percent; and Bavaria, 0.4 percent.

The Association of German Crude Oil Producers forecast a production goal of 26.6 million barrels for 1960. This forecast is supported by the German Geological Survey estimate on proven crude reserves of 348 million barrels. Probable reserves at year's

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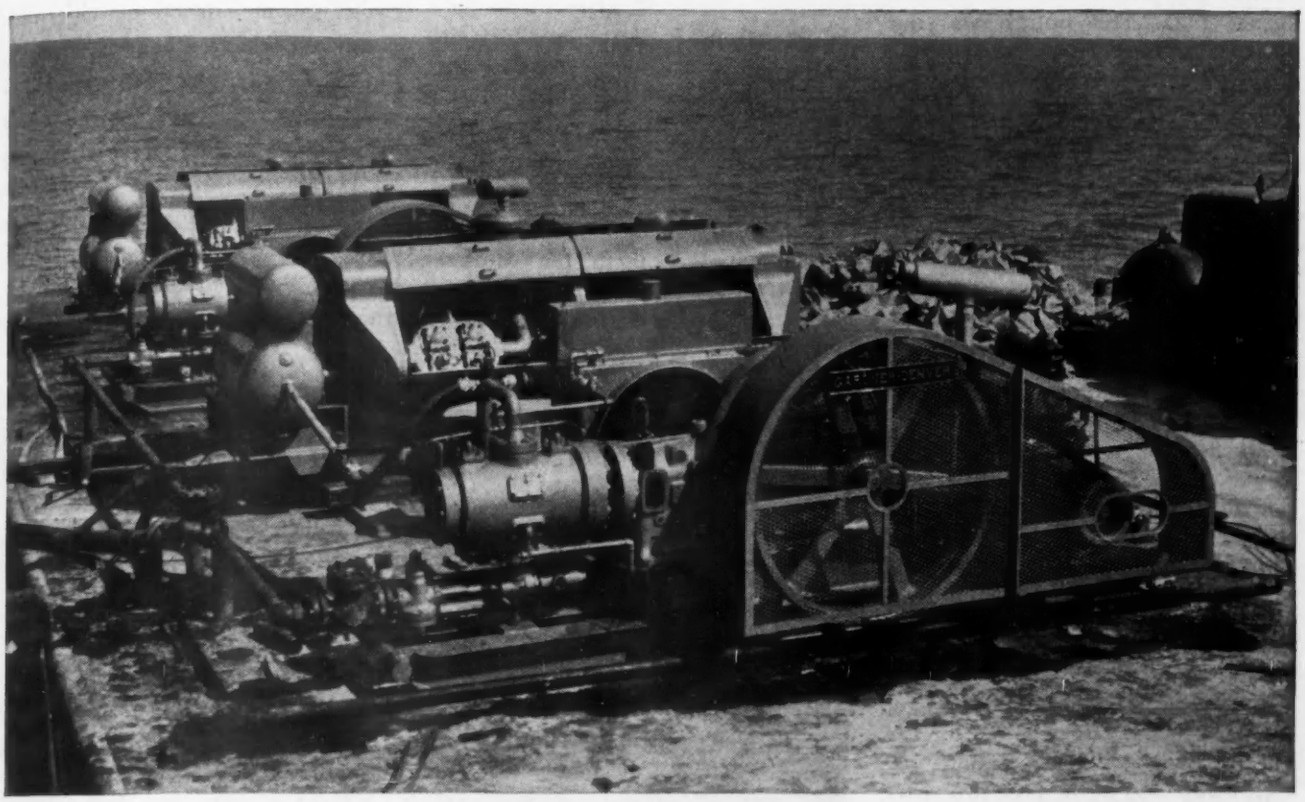

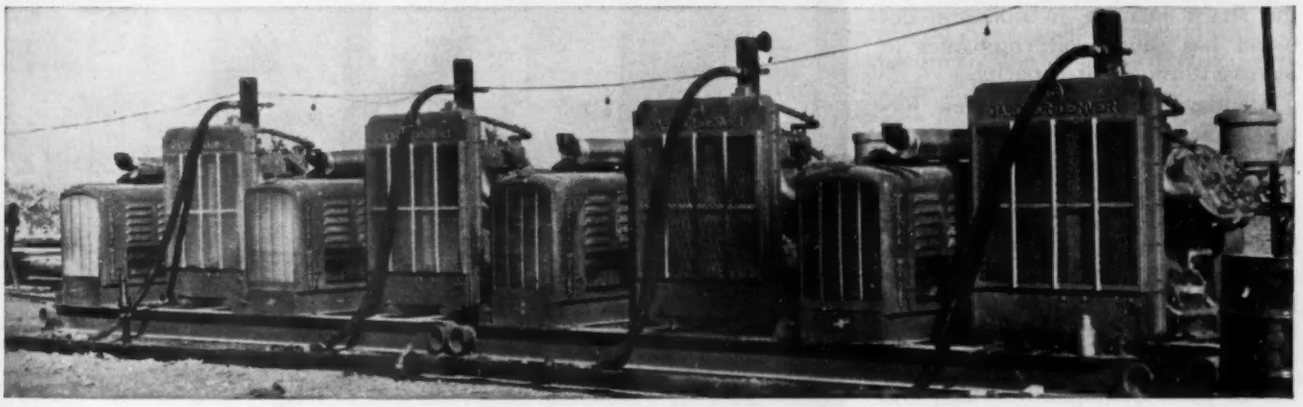

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end were put at an additional 113 million barrels.

A striking increase of Germany's natural gas production was recorded during 1955. This upturn was due primarily to development of the Rehden field, near Diepholz. Also, Stockstadt and Eich gas fields near Darmstadt, in the Upper Rhine Valley, were put into production. During 1955, 8460 MMcf of natural gas was produced, and a further rise was expected for 1956. The 1955 yield was 5.4 billion cubic feet more than 1954 production.

Pipe Lines. Germany's network of crude oil and natural gas pipe lines was extended considerably last year. Total increase for the year amounted to 400 miles, about twice the length available three years ago. Put into operation late in 1955 were 218 miles of crude pipe lines and 182 miles of gas pipe lines.

Refining. While the original refinery expansion program for the Federal Republic, which was outlined in close liaison with the Organization for European Economic Cooperation, has been completed in the past two years, the sharp increase in domestic demand has caused oil companies to increase throughput capacity.

Standard Oil Company (New Jersey) announced the erection of a new plant at Cologne with an annual throughput capacity of 20 million barrels. Later, this throughput will be increased to 35 million barrels annually. Shell Oil Company reportedly intended to enlarge its refinery on the banks of the Sueder-Elbe river at Hamburg-Harburg. Shell was erecting at this point additional cracking and reforming units, as well. There were reports that a new Shell refinery may be erected in the western part of the country.

The British Petroleum Company also was planning to expand its refining facilities in Hamburg-Finkenwerder. Socony Mobil Oil Company announced an increase of its annual throughput potential to 8.75 million barrels.

Total daily crude throughput capacity of West German refineries at the beginning of 1956 amounted to 300,000 barrels, about 10 percent more than in late 1954. It is expected that a further increase of up to about 500,000 barrels daily would be achieved during the next five years.

Actual refinery output last year amounted to 72 million barrels, as compared to 60 million barrels in 1954.

Exploration. Exploration efforts in Germany, as in the past year, are concentrated on:

- Further development of the Jurassic troughs in the northwestern part of the country.
- Discovery of stratigraphic traps.
- Search for oil in the Molasse basin (foreland of the Alps mountains).
- Investigation of deep structures in the Rhine valley graben.

Despite press reports, German oil circles say no offshore activities of a significant nature have been conducted. Greater attention currently is being paid to the pre-Salinarian beds in northwestern Germany, which may be productive at great depths. No deep well has yet reached these horizons because drilling operations in the very thick salt formations are extraordinarily difficult.

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New Discoveries. The number of newly-discovered oil and gas fields claimed for the 1955 exploration campaign depends upon the classification principles applied. Some of the discoveries are listed initially as "oil finds" only, but they may later be developed into commercially-productive fields. However, several new fields found during 1955 are significant.

• In the north, about ten miles northeast of the town of Kiel, near the Baltic Sea coast, Deutsche Erdoel-AG. discovered in April a new deposit in the Dogger beta of the eastern border zone of the Jurassic trough. At the edges of the trough lie the developed oil fields of Ploen, Boostedt and Bramstedt. Kiel 4, the discovery well, initially pumped 63 to 75 barrels of crude. Three additional wells also were completed as producers, and in April, 1956, the field produced about 4500 barrels of oil.

• North of Kiel, Schwedeneck 6b, located at the western border of the same Jurassic trough, found oil in the Dogger horizon, too. But the well soon went to water. However, it was hoped that in a structurally higher location, regular production could be obtained.

• Bramstedt 13 discovered a new pay in the Bramstedt field in Holstein province.

• Meckelfeld-Nord 1, a deep test several miles south of Hamburg, encountered good oil traces in the Posidonia shale at 8000 feet. It remained to be seen, however, whether commercial production could be obtained from this shale formation.

• Lueben 1, a wildcat drilled by Preussag-Elwerath-Mobil Oil-Itag only one mile from the border between West and East Germany, made a major discovery of light oil in the Dogger at about 4200 feet. The location of the new producing area is north of Hankensbuettel field. A second well began producing early in 1956, and in April, 1956, the field was producing about 8500 barrels per month.

• At the northwestern edge of the Gifhorn trough, between Hohne and Oerrel-Sued oil fields, a new field—Wesendorf-Nord—was discovered in the Dogger beta early in 1955. After several other wells were completed as producers, the field was producing at a monthly rate of approximately 3500 barrels.

• At the northern flank of the Vorhop salt dome and east of Hankensbuettel oil field, the wildcat Vorhop-Nord 1, found oil. At mid-1956 it had not been evaluated as a commercial field.

• In February, 1956, Gewerkschaft Brigitta (Shell and Jersey Standard) discovered oil in its wildcat Eilte B5 at 5700 feet. Producing from the Cornbrash (Dogger), the well initially flowed 189 barrels of light crude through a quarter-inch choke. This new field, Eilte-West, has no stratigraphic or tectonic relation with the old Eilte field at the eastern flank of the Eilte salt dome.

• The Gewerkschaft Brigitta-Mobil Oil wildcat Vestrup 1 encountered oil at 6200 feet in the district between the Weser and Ems rivers and east of the Hemmelte-west oil field. Succeeding wells drilled to the Kimmeridge (White Jurassic) were disappointing. It appeared that Vestrop was of only minor importance.

• Of apparently great significance was the discovery made late in March,

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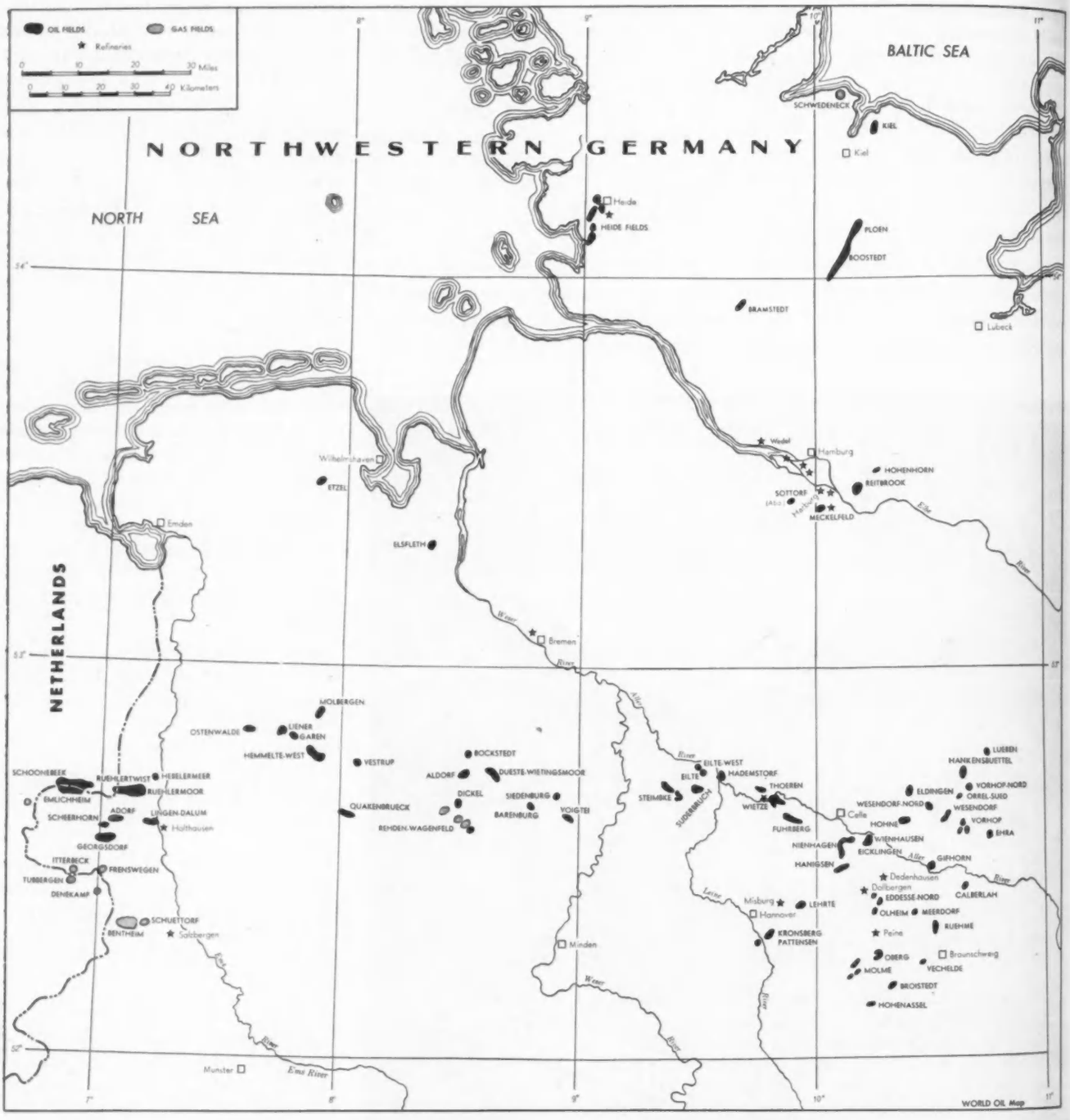

GERMANY . . . Significant new discoveries have been brought in in areas from the Vestrup field, where Vestrup 1 test found oil at 6200 feet, to Lueben, only a mile from the border between West and East Germany, where a major discovery of light oil was found in the Dogger at about 4200 feet.

German Drilling and Production

REGION	Crude Production During 1955 By Region (Barrels)	Natural Gas Production During 1955 By Region (Cubic Feet)	No. of Crude Producing Wells at End of 1955 By Region	No. of Natural Gas Producing Wells at End of 1955 By Region	Amount of Footage Drilled During 1955 (In Feet)	No. of Wells Drilling at December 31, 1955	Number of Field Wells Completed During 1955 and Results			No. of Wildcat Wells Drilled During 1955 and Results		
							Oil	Gas	Dry	Oil	Gas	Dry
Upper Rhine Valley	590,365	1,588,177,186	162	13	241,150	13	12	15	7	3	1	25
Bavaria	79,832	.....	6	..	131,109	7	..	..	..	3	2	15
Emsland	7,974,344	2,762,147,082	799	9	445,983	12	102	..	2	6	3	6
Hamburg*	428,166	.....	....	..	.....	..	..	..	..	..	..	..
Hanover	7,928,172	11,724,514	1,372	..	657,949	21	76	..	19	12	2	46
Weser-Ems	3,279,277	4,098,247,225	214	5	577,443	18	101	2	13	8	1	32
Schleswig-Holstein**	2,065,063	.....	255	..	327,070	9	31	..	3	4	..	9
(Others)	.....	.....	....	..	28,436	2	..	..	..	..	..	6
Total	22,345,219	8,460,296,007	2,808	27	2,409,140	82	322	17	44	36	9	139

* See Schleswig-Holstein (apart from column 1).

** Including Hamburg (apart from Column 1).

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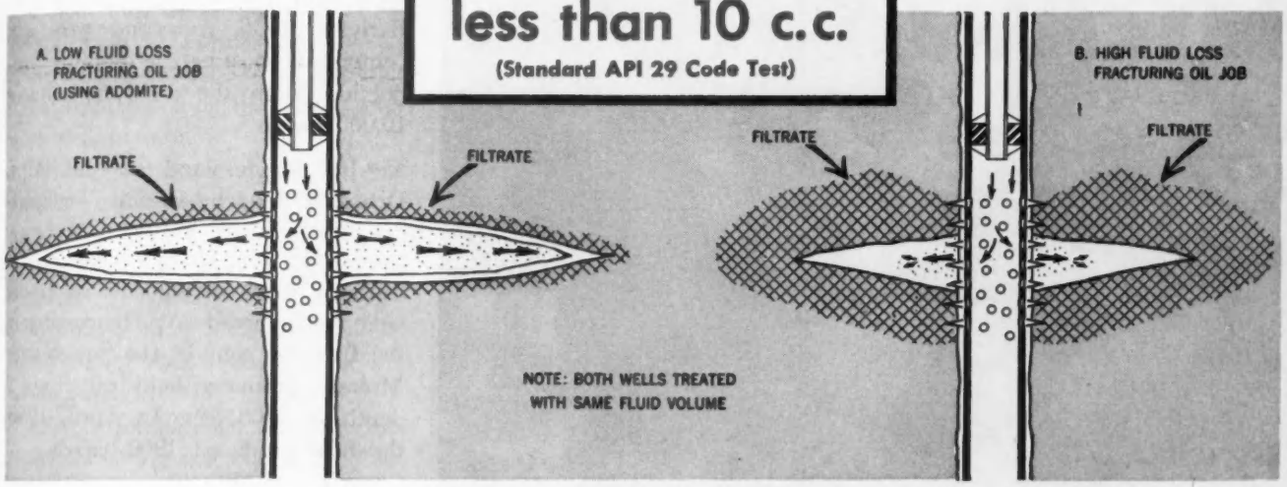
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In Nottinghamshire, tongs are unlatched prior to lowering pipe on the Egmanton No. 1 well.

1956, by Gewerkschaft Elwerath northwest of Bremen and on the left bank of the Lower Weser river. There for the first time, oil was found in a Dogger trough which was previously untested. The discovery well, Elsfleth 2a, struck oil in the Dogger formation at about 5100 feet. The well was pumping about 60-75 barrels of crude daily.

- A promising discovery was made in September, 1955, near the town of Landau in the western part of the Upper Rhine valley, by Wintershall-Mobil Oil-Itag. Crude was found in the sandstones of the Pechelbronn beds with good initial production. Early in 1956, a second well was completed, boosting the monthly production from the field to almost 10,000 barrels.

- In the foreland of the Alps, Deutsche Schachtbau-und Tiefbohrges mbH. found commercial crude production near Heimertingen, where formerly in some wildcats oil traces were encountered. At Heimertingen, the Baustein zone of the Suesswasser Molasse produces light oil from a depth of 5100 feet. In April, 1956, the field produced 1900 barrels.

Supply and Demand. As in 1954, Germany's 1955 crude production filled 31 percent of domestic demand. Additionally, about 52 million barrels of crude was imported during 1955 primarily from Saudi Arabia, Iraq and Kuwait. Imports of products increased because of the continuing high demand for fuel oil. Total oil consumption in Germany last year amounted to almost 75 million barrels.

Great Britain . . .

Egmanton find encouraging.

CRUDE PRODUCTION in Britain dropped to a total of 394,700 barrels in 1955, representing a 9 percent decrease below the 1954 figure, and a 3 percent rise over 1953 production. Still, 1955 was a bright year for British production, as D'Arcy Exploration Company, the British Petroleum Company, Ltd's subsidiary in charge of virtually all exploration and production activities in the United Kingdom,

made a significant oil discovery on a seismic prospect at Egmanton in Nottinghamshire in the East Midlands.

Egmanton 1, located six miles north of Eakring field, struck oil in the Millstone Grit sand of Carboniferous age, in mid-1955. All current production in the Midlands is from the Millstone Grit. Proved oil column at Egmanton to date measures 200 feet, indicating a sizable reserve.

In April, 1956, ten Egmanton wells produced 7200 barrels. Sources estimate that another 50 locations may be proven in the field. The 13 percent aggregate decline in production from the five older fields, Caunton, Duke's Wood, Eakring, Formby, and Kelham Hills can be expected to be more than compensated for by the new production at Egmanton.

Drilling in the Plungar field, discovered in 1953, has been disappointing. Only five of 15 wells drilled in the field by the end of 1955 were producing in mid-1956.

Several of the older Midlands fields were being waterflooded. This program began in 1948.

D'Arcy Exploration Company also was conducting a five-year, $2.8 million natural gas search for the British Gas Council. Last year, work was done in the Cheshire basin. Also, two unsuccessful tests for gas were drilled in Sussex. A third test, at Heathfield, was completed as a small gas well in the Purbeck zone of upper Jurassic at less than 1000 feet. However, as yet no commercial natural gas production has been found in Great Britain.

All told, British Petroleum and D'Arcy Exploration drilled 70,470 feet of hole in Britain in 1955, resulting in 10 oil wells, 1 non-commercial gas well, and 15 dry holes. Two wells were drilling at year's end. Producing oil wells in Britain numbered 224, including Esso Petroleum Company's one well at Dalkeith, Scotland, producing about three barrels daily.

Refineries. Refinery throughput increased about 2 percent to an average of 590,850 barrels daily. In view of rapidly expanding industrial activity, increased interest in petrochemical manufacture, and widespread industrial changeover from coal to oil forced by dwindling domestic coal supplies, large increases in British refining capacity, now crowded almost to the limit, were essential and were under way. The U. K. is second in the world in petroleum consumption, behind the U. S.

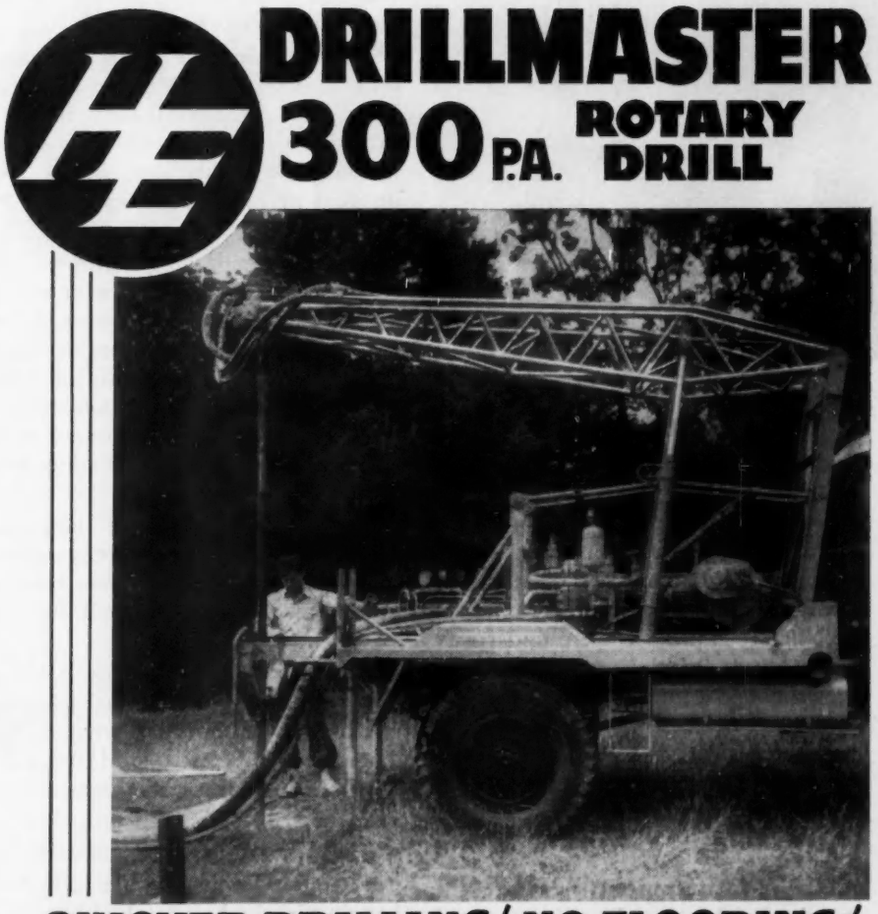
The following refinery construction projects were underway in mid-1956:

1. Berry Wiggins and Company, Ltd., was building an extension to the Weaste refinery at Manchester.

2. South Eastern Gas Board had an oil gasification plant under construction on the Isle of Grain.

3. Esso Petroleum Company had a $14.3 million program underway to expand the Fawley refinery by 35,000 barrels daily capacity, including plans for a 15,000 barrel-a-day hydroforming unit, and a 12,000 barrel-a-day hydrofining unit.

4. In May, 1956, Anglo-American Regent Oil Company, joint Caltex and Trinidad Oil Company affiliate, announced plans to build a $70 mil-



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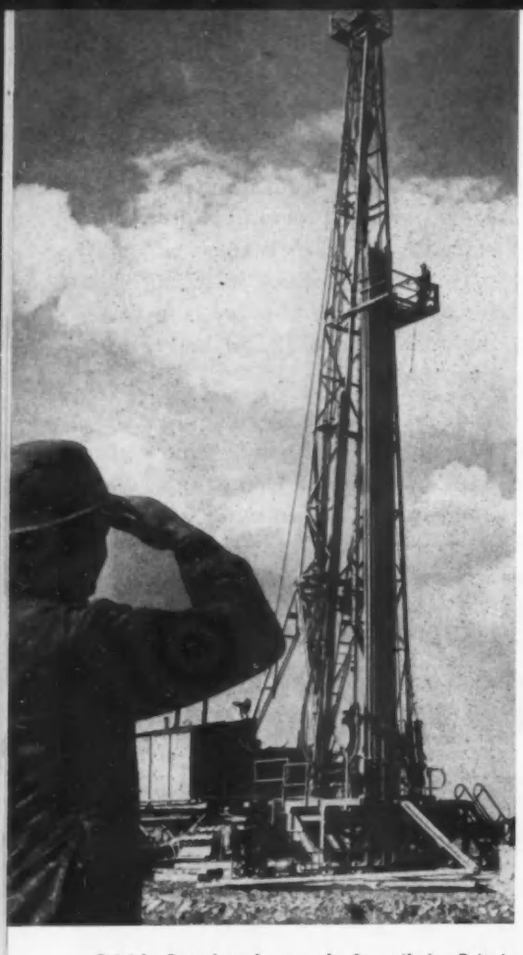

British Petroleum's search for oil in Britain is being pushed ahead and development drilling, at the Plungar, Leicestershire, field, which was discovered in 1953, continues. Above is the No. 3 drilling rig at Plungar.

lion refinery near Southampton to charge more than 100,000 barrels daily, scheduled for 1958 completion.

Numerous projects were under way to expand Britain's already sizable petrochemical industry. Production of industrial alcohols, butadiene and synthetic rubber, styrene monomer, detergent alkylate, polyethyene, epoxides, and ammonia were all being expanded.

Oil Field Equipment. U. K. firms received orders for oil equipment and materials valued at $345.8 million in 1955.

Pipe Line Construction. Costain-John Brown Ltd, after six months' construction work for the Wales Gas Board, completed the first system of gas pipe lines in North Wales in September, 1955, to supply consumers there with a mixed fuel containing manufactured, coke oven, and natural coal gas. A total of 82 miles of pipe was laid, ranging in diameter from 6 to 12 inches. Rhyl, Bangor, Holyhead, and other nearby points in Wales are served by the new system.

Italy . . . Future development remains in question as new law all but nationalizes oil industry.

WITH AN OVERWHELMING vote of 386 to 37, Italy's Chamber of Deputies in July practically nationalized its oil industry. Although the bill, supported strenuously and long by the Communists and left-wing Socialists, apparently permits private capital operations on an exceedingly limited scale, there was no question that private enterprise had been legislated almost out of existence.

Approved in just about the same form that was drawn up by a parliamentary commission, the law retained provisions which, for all intents and purposes, were likely to call a halt on most private capital operations on the peninsula.

Under the bill, the government will receive royalty payments under a high sliding scale substituted previously for an earlier 60-40 profit-sharing plan. Ente Nationale Idrocarburi, the state-owned agency, will retain a monopoly in the Po valley, and maximum acreage allowed under exploration permits is limited.

One of the bill's most damaging blows to private capital was contained in the section which reserves borders around each discovery well for the state.

Thus, Italy's continuing political dispute, which had hindered development of its producing potential, has drawn to a close. Enrico Mattei, ENI chief, had led the fight against private enterprise in the question of whether private capital or state agencies would develop Italian oil. And hanging in the balance had been the needed oil which could be supplied by the four oil discoveries recorded last year—the first except for the first except for the minor production obtained in the Po valley, center of Italy's natural gas producing industry.

Now, the matter of Italian oil is a question. Its development has been put into the hands of the state agency whose record has not warranted the optimism of Italians. And the extent of future private capital operations in the country also remained a question.

The 1955 output of crude oil amounted to 1,581,448 barrels, or 4332 barrels per day.

Natural gas production equalled 127 billion cubic feet last year, of which Ente Nationale Idrocarburi, state-owned agency, accounted for 117.8 billion cubic feet. Natural gas output during 1954 amounted to 104.7 billion cubic feet. ENI's share of 1954 gas production was 95.3 billion cubic feet.

With daily production of only 4332 barrels with which to feed its refineries, whose combined throughput capacity is equivalent to slightly less than half a million barrels daily, and with domestic demand at the 197,000-barrel-a-day level and continuing to rise, the political fight which has been under way is growing in importance.

Wells Closed in. Meanwhile, the government had sealed all oil wells discovered in the peninsula, including Cigno 1 and Cigno 2 wells of Petrosud Company, S. A., at Alanno (a private capital operation), pending Parliament's decision on terms under which concessions were to be granted.

At the same time, the ENI monopoly had been left free to develop its activity.

This situation, of course, offered opponents of private capital an opportunity to show that state-controlled initiative was more active than private efforts. The privileged position of the state monopoly, insofar as oil and gas concessions and exploration permits are concerned, is indicated in Table 1, which shows that ENI holds 69.6 percent, Italian private companies 23.8 percent and joint Italian and private capital from abroad 6.6 per-

TABLE 1
Acres Under Concession in Italy and Sicily

GROUP	Italy	Sicily	Total Acres
Ente Nazionale Idrocarburi	13,976,942	879,459	14,856,401
Italina Private Companies	3,391,119	1,693,097	5,084,216
Joint Italian and Private Capital from Abroad	468,156	938,110	1,406,266
Total	17,836,217	3,510,666	21,346,883

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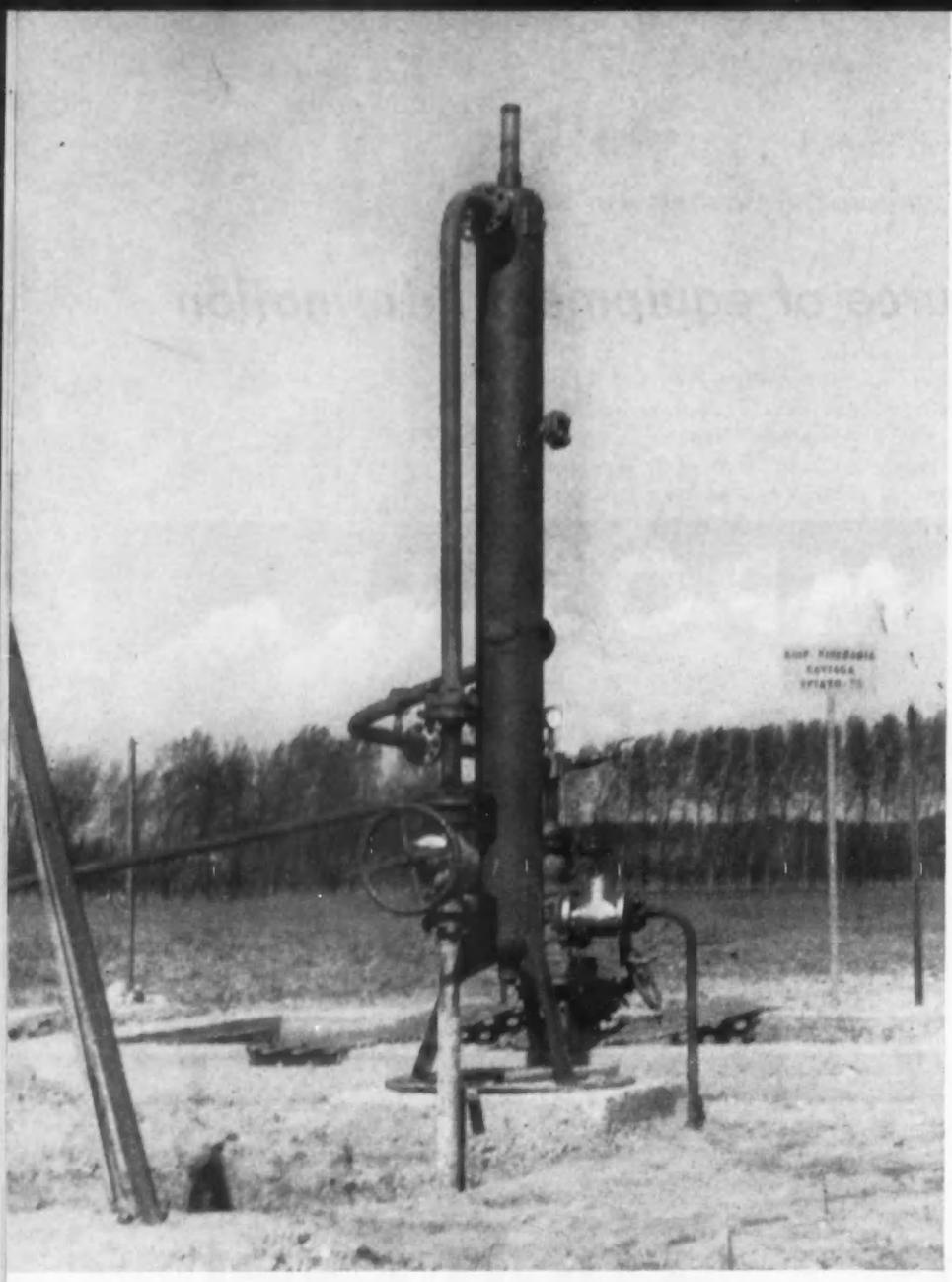


AGIP Mineraria, Caviaga, Sfiato 75, a gas well in Italy.

cent of the total concessions now in effect in Italy and Sicily.

In addition, ENI already has applied to Parliament for 89 new research permits covering 12,355,000 more acres. If the requests are granted for these new concessions, ENI soon will be in a position to control more than 27 million acres, or about 75 percent of the total estimated surface of the territory on which oil and gas research is deemed worthwhile.

In Parliamentary quarters it was confirmed that ENI had refused to extend the Cortemaggiore-Alexandria natural gas pipe line to Acqui and Savona so as to prevent the Montecatini Chemical Products Company from beginning the production of fertilizer from methane in its Cairo Montenotte Works in competition with the fertilizer production which ENI soon is to undertake at Ravenna.

Discoveries. The first of Italy's four oil discoveries last year resulted from private capital efforts. Shortly afterward, Azienda Generale Italiana Petroli, an ENI subsidiary, made three more discoveries in the same general area along the Adriatic sea coast. A total of four oil wells and 10 gas wells, then, was the total number of completions last year.

The private capital discovery occurred at Cigno, near the sea coast about 100 miles east of Rome. Drilled by Petrosud, which is jointly owned by Gulf Oil Corporation and Montecatini Mining and Chemical Company, an Italian entity, the well Cigno 1 was tested at approximately 2000 barrels daily of 34-gravity crude from 2300 feet. Cigno 2, an offset drilled about 1500 feet north of the discovery well, was tested at a paralleling rate of flow. But neither of these wells has been put into production since Petrosud has not been granted a development concession.

It was reported that a continuing water encroachment had affected the producing capacity of both Cigno 1 and Cigno 2.

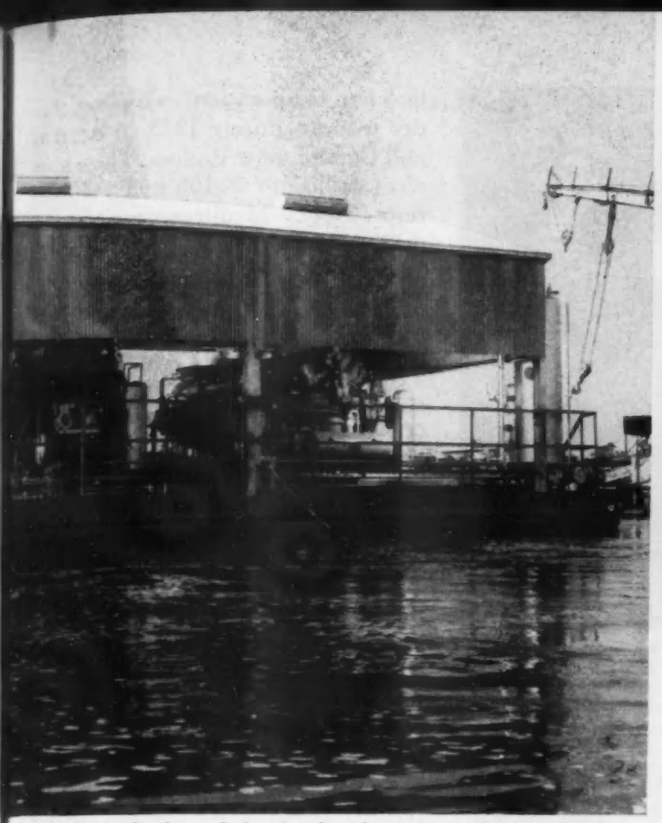
AGIP later brought in Vallecupa 1 less than two miles from the two Cigno wells. The government has permitted AGIP to produce 15,000 barrels from Vallecupa 1. AGIP brought in another reported discovery at Cerni, about 30 miles south of the Petrosud exploration concession in the Abruzzi mountains. A third discovery claimed by AGIP was brought in during November less than a mile from Vallecupa 1.

These discoveries only added fuel to the political fire surrounding the government's discussion of state versus private capital development. The previous petroleum law covering exploration and development was enacted in 1927, and offered no assurance that any private capital firm from abroad would ever be allowed to produce and sell any oil.

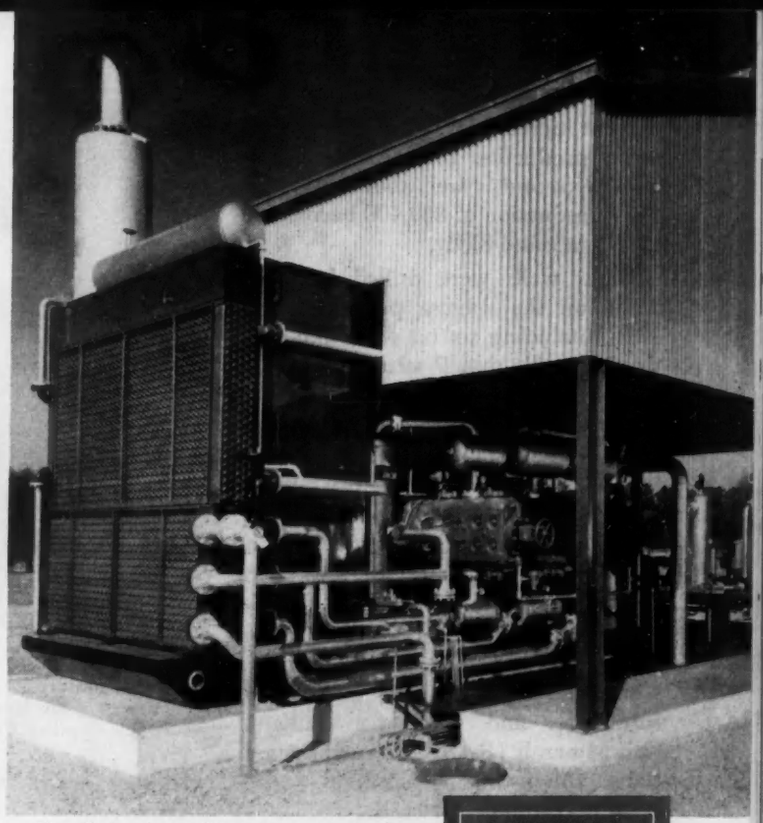
Thus, it would appear that no company operating elsewhere in the world would be interested in conducting operations in Italy. For to do so would mean that the divisions of profits likely would have to be revised upward in other countries where the company operates.

Sicily . . . Production rises. Exploratory drilling moves to flanks of Mount Etna.

EXPLORATION AND PRODUCTION activity in Sicily continued to increase in 1955 and 1956. Production in the Ragusa field, all by Gulf Italia Company, amounted to 954,075 barrels in 1955, or an average of 2613 barrels



Packaged by Southwest Industries these barge mounted Cooper-Bessemer GMXD's handle natural gas compression at this Louisiana Gulf Coast installation of The California Company.



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per day. This output represents a 53 percent increase over the 1750-barrel-a-day production from Ragusa as of mid-1955, and is well above the total 1954 production of 889,400 barrels for all of Italy and Sicily.

Eight wells were drilled by Gulf Italia on the Ragusa permit during 1955, including six oil wells and two dry holes. Ragusa 9 struck an unexpected gas zone while drilling at 6000 feet in early November, blew out, and caught fire. The rig was destroyed, but the fire was put out in five days.

Eight oil wells were producing at the year's end in Ragusa field. Gulf Italia's 1955 drilling footage was 55,862 feet.

Augusta Richerche Petrolifere S.P.A., jointly owned by Standard Oil Company (Sicily), a Jersey Standard subsidiary, and Raffineria Siciliana Olii Minerali (RASIOM), conducted some interesting exploration work west of Catania along the flanks of Mount Etna. ARPE drilled 14,714 feet of hole, and completed one light gas well, Bronte 1, on the west flank of Mount Etna, by the end of the year. Another test, five miles west of Augusta, at Melilli, drilling at the end of the year, was abandoned early in 1956.

A second light gas discovery was made, on the south flank of Mount Etna, at Vasadonna, in early 1956. Production there is from a thin Tertiary sand at 2670-80 feet, and open flow potential is about a million cubic feet daily. Production in Bronte 1, about the same as at Vasadonna, is from an Eocene sand from 3885 to 3895 feet.

Bronte 2, a west stepout located 9100 feet from Bronte 1, was drilling as of mid-1956.

Drilling in the area is very difficult, both on the Etna lava apron and off it. At one time, bits were being worn out at Bronte faster than they could be sent from the U. S. The Mount Etna area is very complexly faulted, and it is doubtful whether the gas found so far will prove economic.

AGIP, the exploration arm of Ente Nazionale Idrocarburi (ENI), continued active operations in eastern Sicily, drilling six wells during 1955, with another in progress at the year's end. AGIP's Catania gas field had eight wells, with five on production and three shut in. A daily average of 5.3 Mmcf. was being produced daily,

H. Warman, geologist, (left) and M. Pennel, petroleum engineer, examine core at Vittoria Well site at Sicily location of D'Arcy Exploration Company.

and that part of the production that is combustible (60 to 70 percent, after removal of carbon dioxide), is consumed at a power plant at Catania. There is a good potential industrial market in Sicilian metropolitan centers, and ARPE's gas, though the present volume is small, is of high methane content and has no carbon dioxide.

Mediterranean Oil Company, a Gulf Oil Corporation-MacMillan Petroleum Corporation, completed two dry wildcats during 1955, at Aragona and Comiso, near Ragusa. These holes were drilled to 10,100 and 7440 feet respectively. Mediterranean's total drilling footage for 1955 was 6993 feet.

SNIA Viscosa, an Italian firm, drilled two dry holes at Enna in Central Sicily, to 1200 feet and 1800 feet, respectively.

In January, 1956, a total of 44 concessions and permits in Sicily had been granted to about 25 different companies, mostly Italian and Sicilian. Total area involved is 3,525,280 acres.

Drilling was increasing in 1956, with about 14 wildcats expected to be completed by the end of the year. Gulf Italia expected to complete seven wells in Ragusa field in 1956 and the rate of oil production there is expected to be doubled by the end of the year.

Sicily is benefiting economically from a regional government with a large measure of administrative independence, favoring private initiative. Persisting reports state that the government is urging Gulf Italia to produce Ragusa oil at an even faster rate than the company wishes to withdraw it. The government receives a 20 percent royalty, plus miscellaneous tax and other benefits.

Spain . . . Exploration program shows first gain, 10 wildcats completed with more drilling in 1956.

LAST YEAR was the first since the inception of a coordinated exploration program in 1952 to show any tangible gain. Then, in 1956 Compania de Investigacion y Exploitaciones, S.A. (CIEPSA) a Spanish company in partnership with C. Deilmann Bergbau of Bentheim, Germany, began testing an apparent natural gas discovery at Zuniga in Navarre Province in northeastern Spain, in the Ebro Valley. The test was spudded in 1954 and reached 10,027 feet by the end of 1955.

Between 3000 and 10,000 feet the well found high-methane gas in 12 separate zones, at pressures ranging up to 4500 psi. A thick Cretaceous section, including some very hard sandstone that slowed drilling rates, was penetrated.

CIEPSA was drilling another wildcat, Apodaca 1, seven miles northwest of Victoria along the south rim of the Pyrenees Mountains, 32 miles northwest of Zuniga 1, and had reached 6900 feet in Lower Cretaceous by the year's end.

A third rig, rated to 16,000 feet, was imported from the U. S. by CIEPSA. In addition, the company carried out 80 party months of geological mapping and 18 party months of seismic work during 1955.

Valdebro, a combine composed of the Instituto Nacional de Industria (INI), General American Oil Company, and DeGolyer and MacNaughton of Dallas, Texas, California Texas Oil Company Ltd, and a number of individuals, continued active exploration throughout the year. San Lorenzo 1, in the Cuenca Basin 78 miles southeast of Madrid, was drilled to 8466

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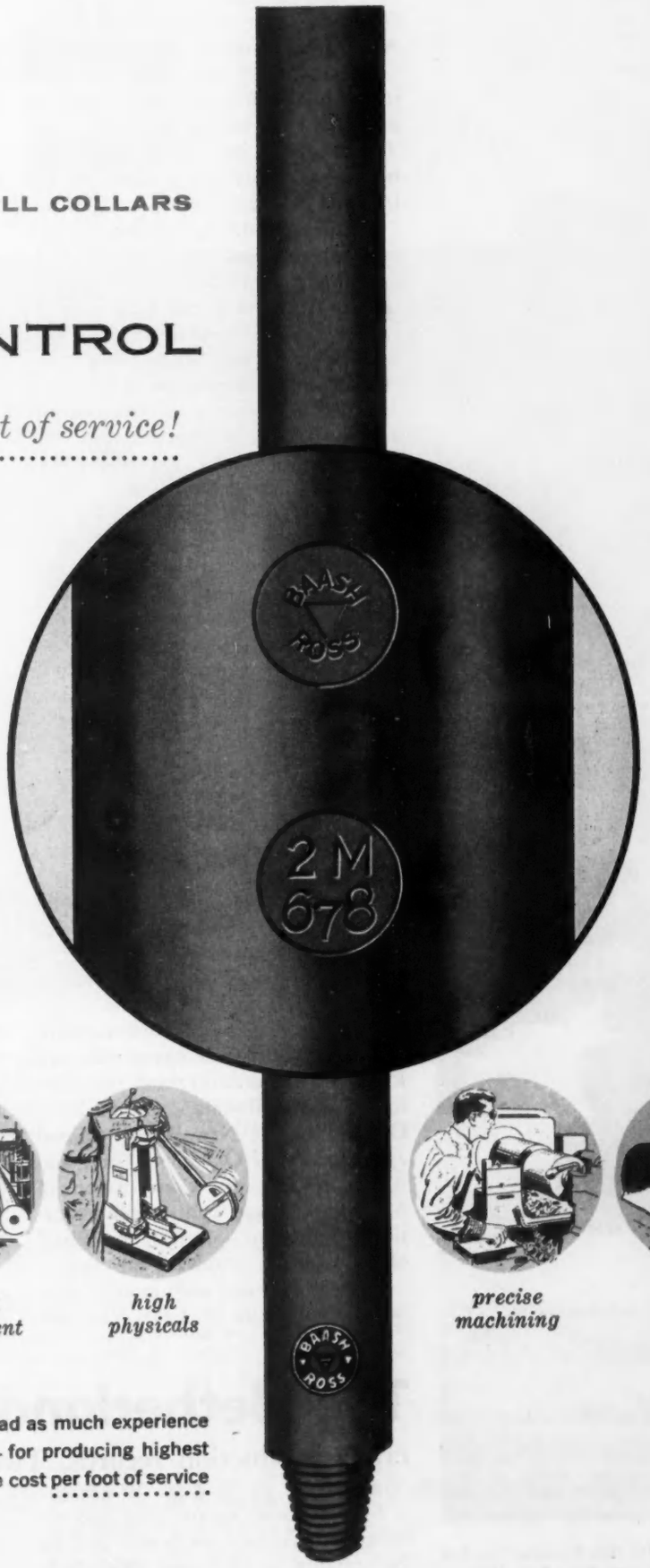

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Photo courtesy of The Shell Petroleum Co., Ltd.
Exploratory drilling near Rijswijk by Nederlandse Aardolie Mij.

feet and abandoned, having penetrated Mesozoic dolomites and evaporites, highly faulted below 3174 feet.

Iglesias 1, 12 miles west of Burgos in north-central Spain, was abandoned at 7162 feet, having drilled out of Tertiary beds into metamorphics at 6880 feet. Valdebro's drilling footage for 1955 was 23,040 feet.

Empresa Adaro, a Government company and a subsidiary of INI, drilled eight shallow tests for about 11,000 total feet in the Guadalquivir valley in southwestern Spain. The Ecija well in the Seville area blew out in the Miocene at 1142 feet. Adaro now has a contract with SAIP, a subsidiary of the Italian oil monopoly ENI, to continue jointly exploration in the area, now aided with seismograph work. Prospects for developing shallow gas reserves were considered good.

Additional shallow wildcats were drilled in each of two localities by private companies—one at the Llobregat river delta south of Barcelona and one near Chinchilla in Albacete province.

CAMPSA, Spain's oil-marketing monopoly, conducted ten party-months of surface geology. In all, ten wildcats were completed in Spain in 1955, and two more were under way at the year's end.

Work continued on the $300 million pipe line system to deliver products to U. S. air bases in Spain. The route of the telescoped 12, 10, and 8-inch line is from Rota on the southwest coast diagonally northeastward across Spain to Zaragoza. Brown-Raymond-Walsh are prime contractors, and Merritt-Chapman and Scott Corporation of New York; Benson and Montin, of Oklahoma City; and Agroman Empresa Construccion of Madrid all have contracts for portions of the line. Stewart and Lloyd of England are supplying the pipe.

Both drilling and seismic work were being stepped up in 1956. Valdebro programmed five wildcats for 1956, and increased drilling by both CIEPSA Adaro-SAIP groups in their respective potential gas areas was indicated.

Despite increasing exploration activity and progress, there was no indication in mid-1956 that more concessions would be granted by the government. None has been allowed since 1952.

Spain's oil consumption is mounting rapidly. Government figures showed daily consumption at 67,700 barrels in 1954, and observers felt that the nation would quickly jump to 100,000 barrels daily if the total supply did not have to be imported. Emphasis on refining has been a partial answer to the problem, and Spain's current 85,000-barrels daily capacity is being expanded.

The Escombreras refinery, near Cartagena, owned by Refineria de Petroleos de Escombreras, SA, in which company Caltex has 24 percent interest, was being expanded to enable handling of 60,000 barrels per day.

In 1955, an average of 40,992 barrels was run to stills at Escombreras, with the capacity rated at 45,000 barrels daily. In addition, an 8000-barrel daily platformer was being built.

Compania Espanola de Petroleos (CEPSA) has a 40,000 barrels daily refinery at Tenerife in the Canary Islands which was being expanded. Procon, Inc., was building a combination crude and vacuum unit there which will expand the plant's capacity substantially. A UOP platforming-Udex unit was recently installed to upgrade gasoline, and to make benzene, toluene, and xylenes from petroleum naphthas. CEPSA planned to expand into the petrochemical field, particularly for manufacture of ammonia and fertilizers.

Plans for a third Spanish refinery, to be built at Bilbao or Santander on the Bay of Biscay, have been reported.

The Netherlands . . . NAM breaks crude production records. Two more fields discovered.

EXPLORATION, PRODUCTION and refining continued to boom in The Netherlands in 1955 and 1956. N V Nederlandse Aardolie Maatschappij (NAM), owned on a 50-50 basis by Royal Dutch Shell and Standard Oil Company (New Jersey) interests, continued to exceed all previous crude production records for the country.

Two oil discoveries were made during 1955, as has been the case in each of the two previous years. Rijswijk

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and Andel fields were found in 1953, Delft and Berkel in 1954, Pijnacker and De Lier in 1955, and newer finds are reported at Wassenaar and Noordwijk.

Royal Dutch Shell companies, such as Jersey Standard affiliates, operate virtually all over the world in many remote places. Royal Dutch made a discovery in far-away Sumatra as early as 1893, and four years later was producing oil in Borneo.

Fifty years later, in 1943, at Schoonebeek, commercial oil was found to exist in Holland, and in 1955 this field yielded more than 90 percent of the domestic crude production. Subsequent discoveries farther west have shown deposits of crude to exist virtually in Royal Dutch Shell's backyard, near the Group's historic home office at The Hague.

As indicated, total 1955 crude production was 7,136,808 barrels, or an average of 19,553 barrels per day, representing a 610,345-barrel rise over 1954's 6,526,343 barrels—or an increase of 9.4 percent. All Dutch oil production is from the lower Cretaceous sandstone or upper Jurassic formations, Andel being the only oil field in the latter category. Gravity range is from 25.1 to 35.4, and all the crude is of paraffin base.

Natural gas production has reached the rate of 14,125,600 cubic feet daily. It is produced from seven fields: Coevorden, De Wijk, Wanneperveen, Staphorst, Denekamp, Tubbergen, and Rossum, the last being a recent discovery. All produce from Permian dolomite.

Domestic crude production fulfills about one-fourth of Dutch needs, now running at about 30 million barrels annually.

Royal Dutch Shell's refinery at Pernis, Europe's biggest, is running at its crude distilling capacity of 220,000 barrels daily. It is undergoing a big expansion, with a 33,000-barrel-a-day cat cracker under construction, slated for third quarter 1956 completion. A 12,700-barrel-daily catalytic reformer, and two hydrodesulfurizer units, of 7800 barrels and 16,400 barrels daily capacity, were all planned for third quarter 1957 completion.

Caltex Petroleum (Nederland) Mij has raised the capacity of its Pernis refinery to 37,000 barrels daily, and has a 7000-barrel-daily platformer and a 4000-barrel desulfurization unit under construction, to be on stream in 1957.

On June 19, Jersey Standard announced that Esso Nederland N. V. would build a refinery near Rotterdam, to handle 30,000 barrels to 40,000 barrels daily. The plant will cost $29 million. Construction on a 395-acre site will begin in 1957 and be completed in 1960.

1955 Crude Production in The Netherlands

Name of Field	Footage Drilled in 1955	WELLS DRILLED IN 1955				Wells Drilling at Dec. 31, 1955	(12-31-55) PRODUCING WELLS			Producing Depths	1955 Production (Barrels)
		Oil	Gas	Dry	Total		Flowing	Pumping	Total		
Schoonebeek	21,683	7	0	0	7	0	0	268	268	2500	6,712,482
Rijswijk	20,394	4	0	0	4	0	8	0	8	5100	289,643
Pijnacker	11,600	2	0	0	2	0	1	0	1	5800	82,558
Berkel	5,154	1	0	0	1	0	0	2	2	3600	20,465
Delft	3,944	1	0	0	1	0	1	2	3	3800	17,170
De Lier	7,008	1	1	0	1	0	1	0	1	5300	10,670
Andel	1,017	1*	0	0	1*	0	0	0	0	3900 & 4700	3,869
Total	70,800	17	1	0	17	0	11	272	283	....	7,136,806

* One well deepened.

Algeria . . . New discovery brightens hopes to halt production decline.

A 456-BARREL-A-DAY oil discovery completed early in 1956 has done much to brighten the immediate outlook of Algeria's petroleum industry. Algeria has been experiencing a serious and continuing decline in crude production since its record production year of 1953. That year total annual production of 637,000 barrels from Oued Gueterini, the country's only oil field, amounted to a daily average yield of 1740 barrels. During 1955 and with 38 wells producing, Societe des Petroles D'Aumale (SPA), operator of Oued Gueterini field, reported total crude production of 433,929 barrels, or 1189 barrels daily. The 1955 crude output represented almost a 25 percent drop from the 1954 average of 1575 barrels per day.

In January, 1955, Oued Gueterini's daily average production was 1418 barrels, declining to 1049 in December. Average production in 1956 was

Drilling in Algeria

COMPANY	Concession	Number Square Miles in Concession	1955 WELLS COMPLETED				Total Development Wells	Total Exploratory Wells	Total Wells Drilling at Year End
			Oil	Gas	Dry	Total			
SPA	Oued Gueterini	9.5	6	0	9	15	15	0	0
	Sidi Aissa	1150.0	0	0	2	2	0	2	0
SN REPAL	Hodna	3615	0	0	4	4	0	4	0
	Ouled Djellal	6240	0	0	1	1	0	1	1
	Berraina	7112	0	0	1	1	0	1	0
	Oued el Toggourt	7112	0	0	0	0	0	0	0
	Oued Rharbi	9360	0	0	1	1	0	1	1
	Oued Fahl	6864	0	0	0	0	0	0	1
	Oued Mya	6864	0	0	0	0	0	0	1
	Oued Saret	3120	0	0	0	0	0	0	0
	Colomb-Bechar	16848	0	0	0	0	0	0	0
	Constantine	2111	0	0	5	5	0	5	0
	Tebessa	6569	0	4	1	5	5	0	0
CREPS	Sahara (Two blocks Seven permits)	66550	0	0	3	3	0	3	1
CPA	Contiguous permits: Timmimoun, In Relbel, Fort MacMahon, Tademait, Hi Inifel, Hi Msegguen, Hi El Biod	62400	0	0	6	6	0	6	0
CFP(A)	Oued Mamous	8736	0	0	0	0	0	0	0
	Erg El Anngueur	6488	0	0	1	1	0	1	2
	Laghouat	6240	0	0	0	0	0	0	0
	Djemaa	6240	0	0	0	0	0	0	0
	Ouargla	8736	0	0	0	0	0	0	0
	El Golea	8112	0	0	0	0	0	0	0
	Fort Miribel	3120	0	0	0	0	0	0	0
Total	.....	253,596.5	6	4	34	44	20	24	7

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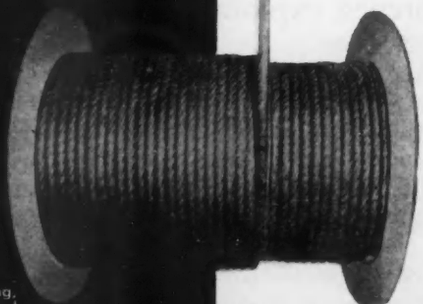

Patent Nos.: Counterbalanced Spooling, Nos. 2,734,695; 2,732,150. Controlled Parallel and Helical Spooling, Nos. 2,708,080; 2,620,996. Appli. of grooving, Nos. 2,599,926; 2,204,938. Removable End Fillers, No. 2,216,819. Other patents pending.

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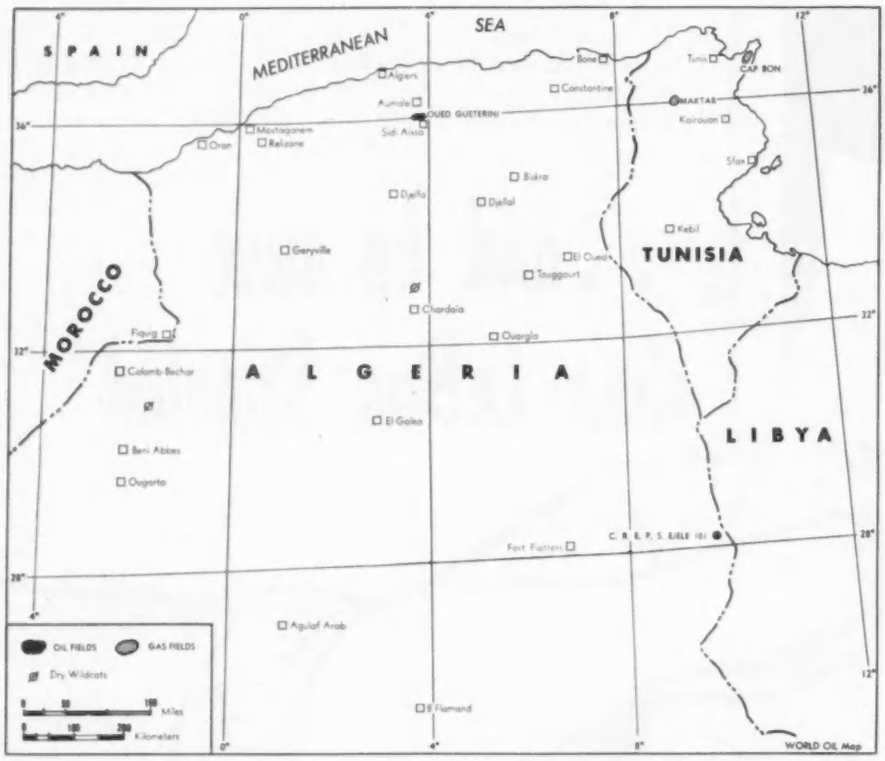

ALGERIA . . . Oil found in wildcat near Fort Flatters and two miles from Libyan border as exploration begins to show progress. Another test was under way in the discovery area, which is extremely remote and is handicapped by lack of water and storage.

expected to fall below 1000 barrels per day.

So it is of signal importance that exploration is beginning to show real progress. It was in a shallow core test in the Fort Flatters area in March, 1956, that the exploratory test of Compagnie de Recherches et D'Exploitation de Petrole au Sahara (CREPS) struck oil at a location less than two miles from the Libyan border. The well, in the Sahara desert of extreme southeastern Algeria, found 35-gravity sweet oil, containing 30 percent light gasoline, at about 1475 feet. Operators ran 4½-inch tubing to 1640 feet. From March 22 to March 30, the well—Edjele 101—was reported flowing 19 barrels an hour on production tests. Pennsylvanian-age rocks are at the surface, and the pay was reported to be of the same geological age.

The discovery area, extremely remote, is handicapped by lack of water and storage. Drilling water was brought to Edjele 101 by tank truck from Honet, 112 miles away, at a cost of $600 a day. Since oil was discovered, operators have been considering constructing a pipe line to a water source found recently only 41 miles distant.

Another exploratory test—Edjele 102—was spudded March 25, 1956, and had reached 837 feet by April 17. Norafor is the drilling contractor.

CREPS has cleared a landing strip, with radio communications, near the discovery. Rapid development of the remote discovery reflects the fact that if the Edjele well remained the 456-barrel-a-day producer that tests indicated, it alone was equal to 15 wells in Oued Gueterini producing area.

The concessionaire just across the border from the discovery is Esso Standard (Libya) Inc.

The five companies operating in Algeria reported total 1955 drilling footage of 228,361 feet, a 6 percent decrease from 1954's 244,000 feet.

The drilling operations were divided as follows:

- Societe Nationale de Recherche et d'Exploitation des Petroles en Algerie (SNREPAL)—93,600 feet, down 26 percent from 1954.
- CREPS—41,300 feet, up 27.4 percent.
- SPA—35,558 feet, down 30 percent.
- Compagnie Francaise des Petroles (Algerie) CFP/A—29,553 feet, up 75 percent.
- Compagnie des Petroles d'Algerie (CPA)—28,350 feet, down 17 percent from the previous year.

Reconnaissance geological work, originally done by SN REPAL and others, indicated the following northern Algerian were promising:

1. The Mio-Pliocene basin of Chelif and Mitidja, on the Mediterranean seaboard east of Oran.

2. The Hodna Eocene basin, southeast of No. 1 (above) and south of Algiers, where indications of heavy crude deposits have been noted.

3. The south Tell area.

CFP(A), holding more than 51,000 square miles in seven permits in the Great Western Erg, in central Sahara near French Morocco, had applied for additional permits to link together its holdings. Encouraging indications of natural gas have been encountered.

—Source of parts of this data is *Le Journal des Carburants.*

Egypt . . . 1954 oil law reversal begins to reflect in heightened exploration activity.

EXPLORATION ACTIVITY heightened in Egypt in 1955, and increased production, refining and pipe line activity in the future was indicated as the impact of an improved legal atmosphere for private capital began being felt. This change in attitude toward private capital from abroad began in 1954 after a six-year dispute originated between the government and Anglo-Egyptian Oilfields, Ltd. (Shell) and Socony-Mobil Oil Company (then Socony-Vacuum Oil Company).

In 1948 the companies made partnership discoveries at Asl and Ras Matarma, but the same year, the government adopted the Mines and Quarries Law. The legislation made further exploration economically prohibitive for the companies and forced them to limit their operations to producing only existing fields.

The law then provided that only companies owned 51 percent by

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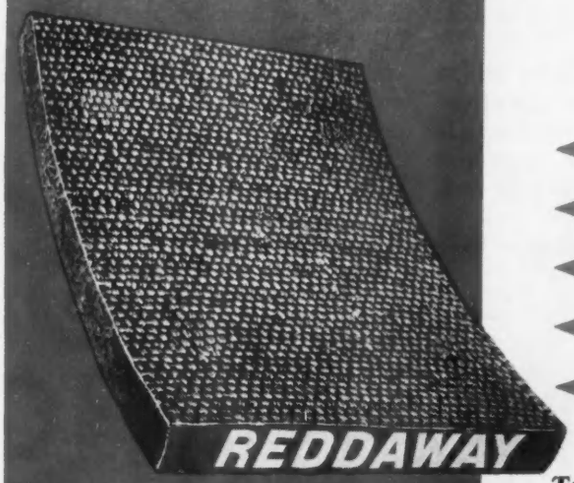

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Egyptian nationals would be permitted to develop new fields. Thus, it blocked the production of new oil after money had been spent to discover it.

But in evaluating 1955 operations, as well as those reported during the first half of 1956, Egypt itself could attest to the value of the oil law policy reversal.

Crude production last year amounted to 12,740,205 barrels—35,453 barrels daily—all from the eight fields in the Suez graben area of eastern Egypt. This reflected a decline of 5.9 percent from production during the previous year.

Too, the decline also indicated the seriousness of the depletion of the old fields. Production from the new Wadi Feiran field, a February, 1954, discovery located on the east side of the Gulf of Suez from Ras Gharib, flowed 2000 barrels a day. However, it failed to offset entirely the production decline that has resulted from the lack of drilling on the Sinai peninsula. The drilling decline, in turn, was a result of the unfavorable legal situation from 1948 to 1953.

But with increased incentive to explore and develop, operators may be expected to reverse the downward production trend this year and in the immediate future, granting the continued existence of a favorable legal climate in Egypt.

Two flowing wells had been completed in Wadi Feiran field as of mid-1955. Two more were completed by year's end. National Petroleum Company of Egypt (U. S., Italian government, Swiss, and Belgian interests) discovered the Belayim field in January, 1955, when Belayim 1 came in flowing more than 2100 barrels of 23-gravity oil from a 40-foot Miocene sand at 7300 feet.

The two fields are 15 miles apart on the west edge of the Sinai peninsula. By the end of 1955, six wells had been completed in the Belayim field. At least five, and possible six, separate Miocene pays were reported below 5100 feet. Some geologists have expressed the belief that the field will prove larger than Ras Gharib, on the west side of the Gulf of Suez. At least a 300 million-barrel reserve is indicated at Belayim.

A deep test which was being drilled by NPC in mid-1956, three miles from established Belayim production, was intended to reach Eocene strata and its completion was being awaited with interest.

Egyptian government officials have made it clear that the nation is determined to satisfy its petroleum needs with domestic production. Last year, Egypt consumed oil at the rate of 75,000 barrels daily, slightly more than twice its domestic output, requiring importation of the deficit.

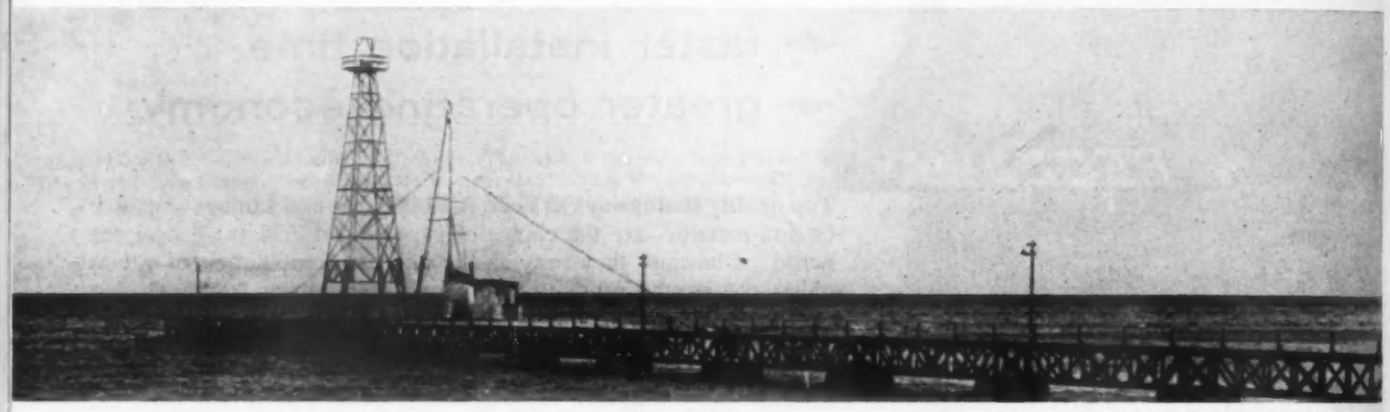


Photo courtesy of Anglo-Egyptian Oilfields, Limited

A view of the two directionally-drilled wells which have been sunk by the Anglo-Egyptian Oilfields Limited at Ras Gharib, Egypt. The foundations are built on the edge of a coral reef.

Other Exploration. Exploration proceeded rapidly during 1955 in areas acquired by Conorada Petroleum Corporation under government concessions granted early in 1954.

In Western Egypt, Sahara Petroleum Company, the operator (a subsidiary of Continental Oil Company, originally named Egyptian-American Oil Company) worked a 90,000 square-mile area comprising all of Egypt north of the 28th parallel of north latitude, west of the Nile river excluding the delta, and into the Mediterranean sea as far as Egypt's national rights apply.

There are two separate concessions with the Conorada concession lying west of the 30th meridian of east longitude (Continental and Ohio Oil Company) and a smaller concession bounded by the 30th meridian on the west and the Nile river on the east, which is called the Cities Service concession. In the latter, Richfield Oil Corporation also holds an interest.

Sahara Petroleum's first wildcat, Burg el Arab 1, located 28 miles southwest of Alexandria, was spudded in during June, 1955. Slight oil shows were encountered at 5100 feet. Drilling had reached 10,000 feet by the end of 1955, and the well finally was abandoned in early 1956 at a total depth of 13,300 feet.

Sahara's second wildcat, at Wadi Natrun, located about midway between Cairo and Alexandria, had reached 9157 feet in original hole in early 1956. But after a fishing job, it had to be sidetracked at 6200 feet. Latest depth reported in the new hole was 7200 feet. In mid-1956, a third rig was being moved into the Western Desert area to drill a test near Mersa Matruh.

In the quarter ended January 31, 1956, Southern California Petroleum Corporation, negotiated a new two-year drilling contract with International Egyptian Oil Company to replace the original contract. Also, Southern California Petroleum organized a new, wholly-owned foreign subsidiary drilling company, Camdrill International, Inc., a Panama corporation, to handle the new contract with International Egyptian. Camdrill purchased and shipped to Egypt two new 12,000-foot drilling rigs. These rigs were scheduled to be used in drilling development wells for International Egyptian in the Wadi Feiran and Belayim oil fields.

Morocco . . . SCP discoveries generate optimism for future domestic production.

EVEN WITH a domestic supply of oil which falls shy of growing demand to the extent of 93 percent, due to depletion of its older fields and lack of proved oil areas, the discoveries of new potential oil sources and favorable geological indications of others combined to generate a spirit of optimism in Morocco's petroleum circles in 1956.

Societe Cherifienne des Petroles (SCP) holds 11,430 square miles—7,315,200 acres—in concessions, representing virtually all the area that is underlain by sedimentary strata. SCP's 1955 exploration program resulted in the drilling of 39 wells with a total footage of 184,890 feet of hole, including 16 wildcats which accounted for 102,409 feet. Fifteen of the wells were development efforts and eight were stratigraphic tests. Four wildcats were completed as producers.

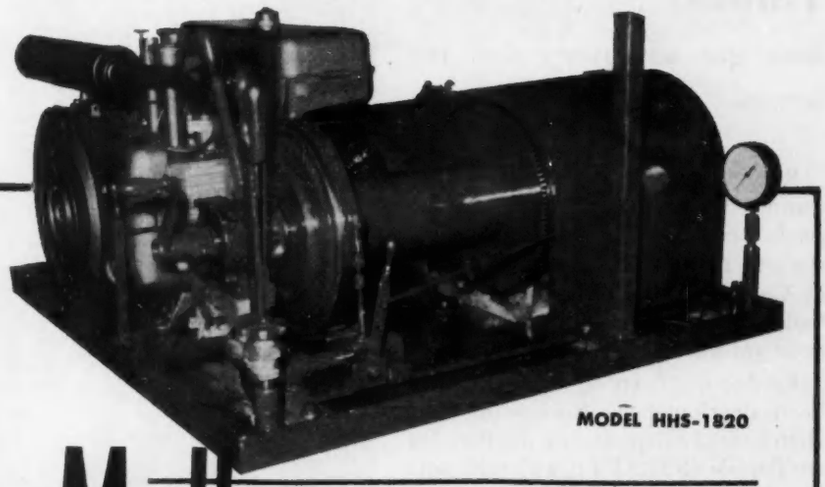
At year's end, eight rigs, mostly U.S.-built and manned, were in operation.

Results of SCP's program in 1955 included:

- Discovery of new oil in the Mesozoic formations in a section northwest of Upper Bled Khatara by Wells KH 21 and 22. While adverse conditions were making commercial development difficult, SCP planned to put the new pool into production through a drilling program using an oil emulsion phosphate base mud to speed up drilling.
- Discovery of a new pool by Well KH 25 on the eastern boundary of Primary Bled Khatara. Production totaled 125 barrels a day with four flowing wells until December. At that time, Well KH 27 increased daily production to 228 barrels. It was believed that a potential existed for further increases in both Paleozoic and Mesozoic pools.
- In March, Well ZR 6, 1½ miles northeast of the eastern boundary of Lower Bled Khatara, found a new 200-foot thick pay in fractured granite at 5600 feet. Thus far, the well has behaved like most other fracture-porosity wells. It came in at 6000 barrels daily, dropped quickly to 315 barrels and later to 125 barrels. Total output from the new pool amounted to 39,164 barrels from April 1 to Dec. 31.
- In December, 1955, Well ZR 11, in the same vicinity as Well ZR 6, found what was described as a separate pool along the Sidi Fili fault.
- Re-examination of prospects which ten years ago were regarded as having no possibilities led during the year to the completion of a commercial oil discovery. Well BD 129, on the Djebel Bou Draa overlooking Petitjean, found oil in a calcareous formation in the Domerian at 2100 feet. BD 129 has been producing about five barrels a day on the pump.

Also, in the Outita section about five miles southwest of Petitjean, Well OT 8 logged oil shows from the Domerian; however, it could not be classed as a commercial producer because the pay zone was calculated to be too small to justify commercial development.

Crude production in 1955 totaled 757,740 barrels, or 2076 barrels daily,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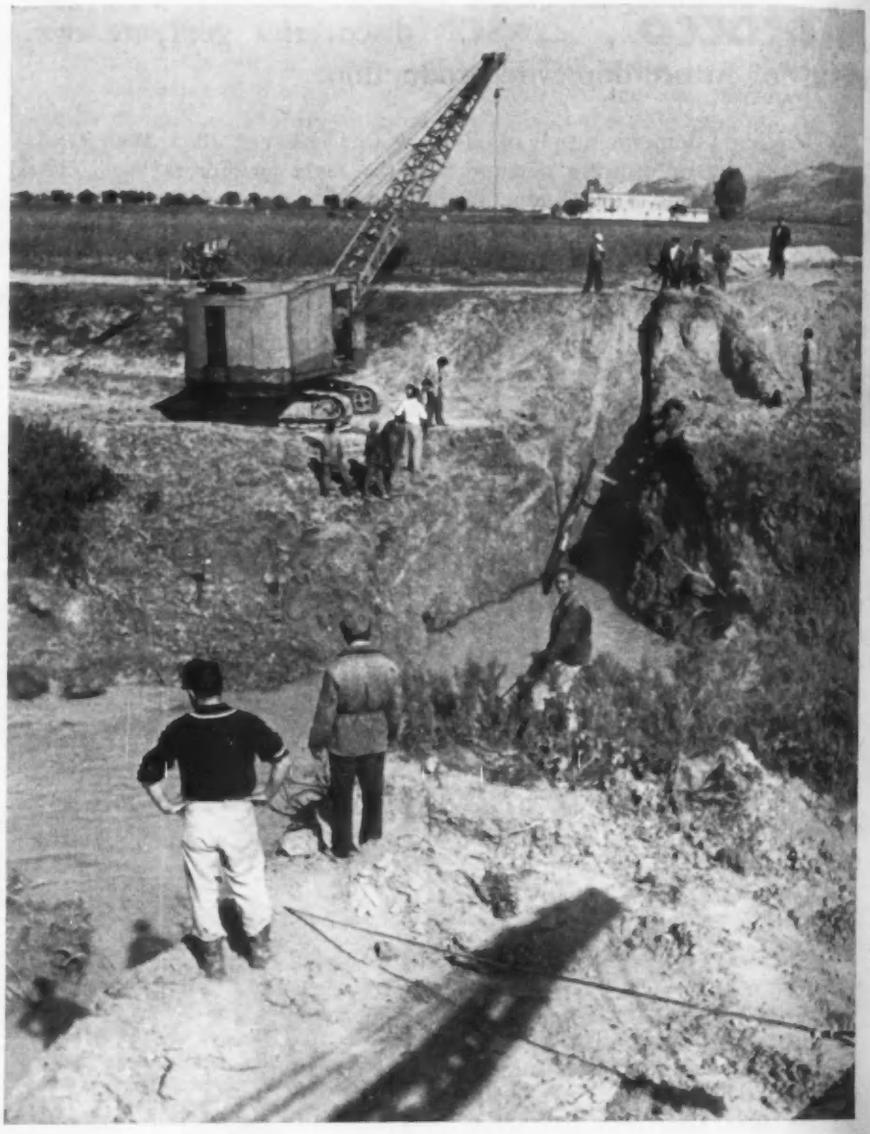
which represents a 14 percent decrease from 1954 and 1.3 percent below 1953.

A four-inch 15-mile pipe line was laid from Sidi Fili oil field to the Petitjean refinery, which operates entirely on domestic crude and fulfills only 7 percent of domestic requirements. The refinery was operating under its charging capacity of 2700 barrels.



Laying a pipe line across the Oued Miliane in Tunisia.

Tunisia . . . Country's lone gas discovery ups reserves.

Reduced oil activity in Tunisia during 1955 resulted from the unsuccessful exploration which was conducted in 1954. A natural gas field at Cape Bon, in the extreme northeast, is Tunisia's only hydrocarbon deposit yet discovered.

Production from this gas field has been developed by Societe de Recherches et D'Exploitation des Petroles en Tunisie (SEREPT), which is composed of French and Tunisian interests, both government and private. During 1955, SEREPT's gas production totaled 156,445 Mcf. and 4895 barrels of natural gasoline—almost three times 1954's output of 55 Mmcf. Production is from a sandstone at about 5000 feet.

During 1955, the field's gas production was transported through a 4-inch pipe line into the City of Tunis for industrial use.

Production during 1956 was expected to reach 176.6 Mmcf. Reserves as of Jan. 1, 1956, were put at more than 7063 Mmcf., sufficient to satisfy Tunisia's expected anticipated natural gas requirements for at least 15 years.

The exploration and drilling program for 1956 was to revolve about the completion of work programmed and begun during 1955. The principal prospective area lies in the southeastern section; however, some activity also was scheduled to take place in the Feriana area, contingent upon the results achieved on the other side of the border.

SEREPT completed three wells last year, had three drilling at year's end, and completed two stratigraphic tests. All but one of these efforts were in unproved areas, and all but the development well Cape Bon 8 were dry. SEREPT drilled 46,633 feet of hole, 11 percent greater than the total for the previous year.

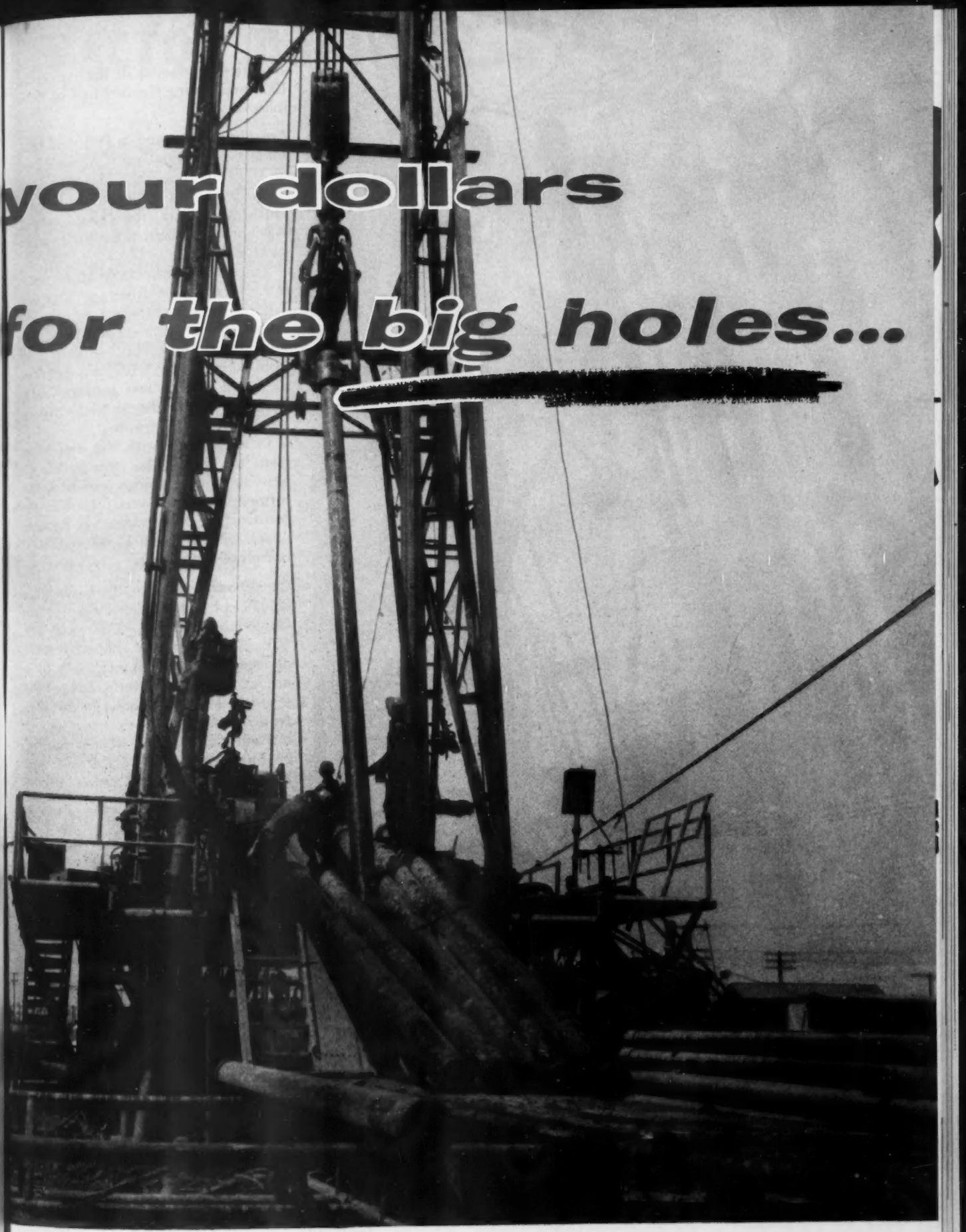
The only other company operating in Tunisia, Compagnie des Petroles de Tunisie (CPDT) is owned 65 percent by Royal Dutch Shell. SEREPT controls the remaining 35 percent. CPDT holds a concession, Permis du Sahel, which was granted in August, 1949, bordering the northeast coast near Sousse and extending about 60 miles inland. Total area of the permit is 4727 square miles.

In March, 1956, CPDT applied for an additional 470 square miles adjoining the south border of the old permit area.

CPDT's 1955 activity included seven tests completed, with one drilling at the close of the year. Another wildcat location had been staked.

Total footage drilled by CPDT amounted to 26,870 feet during 1955. Target of most of the wells was the Cretaceous section, but one of the deeper tests, Ktir 2, was bottomed at 9088 feet in reported Triassic rocks.

Drilling in northern and central Tunisia was expected to be curtailed when 1955's exploratory programs were concluded in 1956. Southern Tunisia, bordering Libya, was expected to receive more emphasis. SEREPT has virtually all of the southernmost region of Tunisia under concession.



NATIONAL USS SEAMLESS

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Photo courtesy of Shell Petroleum Company

Derrick man on a rig at Nzam, 70 miles north of Owerri, Nigeria, latches elevators onto the 90-foot stands of drill pipe during running-in operations.

Other Africa . . . Three coastal discoveries reward extensive exploration. Search continues.

AT LONG LAST, drilling and exploration activities scattered over the vast area of Africa south of the proven fields of Algeria, Morocco and Egypt have resulted in three significant discoveries of oil. A summary of activities conducted in the region in 1955 and during the first half of 1956 follows:

Angola. Carbonang, a Petrofina subsidiary, found Southwest Africa's first oil field in mid-1955. The discovery well, Bem Fica 2, located 13 miles south of Luanda, the capital, tested 200 barrels of light crude daily from 8400 feet.

The success culminated three years of exploration, including stratigraphic drilling, on a 30,000-square-mile concession along the northwest coast. By the end of 1955, two oil wells had been completed at 8400 feet and shut in. From seismic and geologic data, Petrofina was confident that a major reserve had been proven.

In accordance with the concession from the Portuguese government, a new subsidiary company was being formed, and plans were underway for construction of a refinery at Luanda which will run from 10,000 to 20,000 barrels of crude daily.

Cameroons. Societe de Recherches et D'Exploitation des Petroles du Cameroun (SEREP—CA) well LA 101 in the Logbada coastal area, about three miles east of Douala, blew out at 5787 feet after encountering several oil and gas shows below 5231 feet, in 1955.

With the help of Myron Kinley, Houston fire-fighter, LA 101 was brought under control and completed as a shut-in gas well.

By the end of the year, wells numbers 102 and 103 were being completed on the same prospect. Oil was reportedly discovered at about the same depth as the gas in LA 101.

French Equatorial Africa. Societe des Petroles D'Afrique Equatoriale Francaise (SPAEF) completed six wells in 1955. About 14 miles south of Port Gentil on the Ojouri structure, a well flowed at the rate of 50 barrels hourly from 4150 to 4183 feet before being shut in. A confirmation test and three other well sites in the area had been staked by early 1956.

The apparent Southwest African discoveries are fairly close together, as African distances are measured. The Douala, Cameroons, area is located at the "right angle" of the African coast where it swings from due east to due south. Port Gentil in French Equatorial Africa is 360 miles due south of Douala. The Angola dis- abandoned in May, 1955. Oil shows

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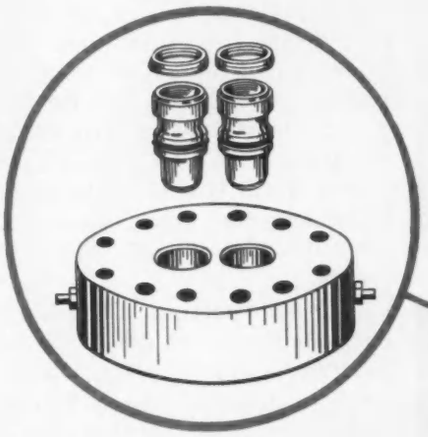
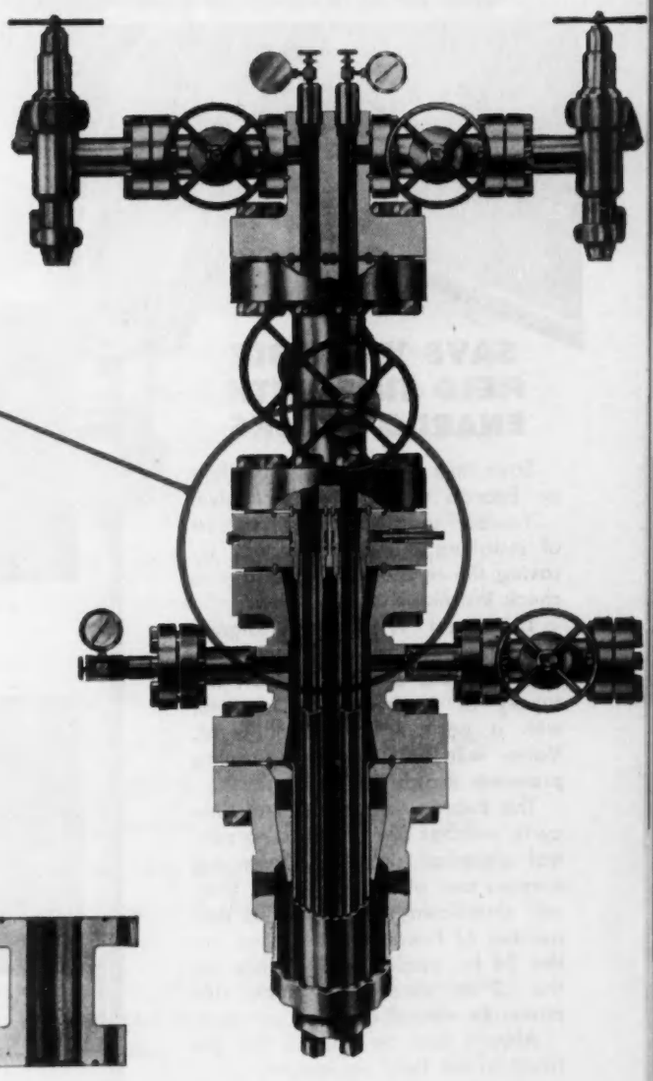
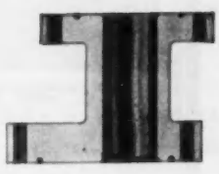




SIMPLICITY: The flange has two full opening tapered bores in which the strings are suspended by threaded mandrels. This eliminates mating and sealing two tubing hangers in a single, large bore. Each string can be suspended, temporarily sealed, and held down independently of the other assuring maximum ease of installation with complete control of well.

FLEXIBILITY: Regular 2" API upset tubing can be run or pulled through the bores in the flange.

METAL-to-METAL SEALS: Each mandrel is independently sealed by a metal seal ring in the groove at the junction of mandrel and flange. This metal-to-metal sealing arrangement also acts as a hold-down. "O" Rings on the mandrel provide a temporary seal during completion and permit testing the seal after Christmas Tree is installed. Mandrels are grooved for hold-down locking screws, which are optional in the flange.



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covery is 770 miles south slightly east of Port Gentil. All three areas are on the coast and convenient to tanker loading when facilities can be provided.

The Angola discovery appeared certain to prove of major importance, with the extent of the other two awaiting further developments. All three are in an excellent position market-wise, since no other oil source is so near to the Union of South Africa and adjacent consumer areas, barren of proven crude resources and with prospects dim for finding any.

Libya. No drilling has taken place as of the end of 1955, but it was clear from the feverish concession activity that took place all year there that prospects for exploratory drilling in the near future were good.

By the end of February, 1956, the entire coastal area of Libya was under concessions to a dozen different operators. Solid concession areas extended to a minimum of 75 miles inland, and in Tripolitania to a maximum of 240 miles inland. Concessionaires include Nelson Bunker Hunt of Dallas, Texas; Esso Standard (Libya) Inc.; Mobil Oil of Canada, Ltd.; Libyan-American Oil Company (a Texas Gulf Producing Company affiliate); Cie. Francaise des Petroles; Texaco Overseas Petroleum Company, sharing concessions with California Asiatic Oil Company, a Standard of California subsidiary, on a 50-50 basis; Continental Oil Company of Libya; Amerada Petroleum Company of Libya; Oasis Oil Company, a subsidiary of Ohio Oil Company; Anglo Saxon Petroleum Company (Shell interests); and D'Arcy Exploration (Africa) Ltd. More than one-fourth of all Libyan territory is under concession. Libya's area totals 633,040 square miles, more than twice the area of Texas. Many of the companies have done surface geological work and some reconnaisance geophysics, too, particularly magnetometer and gravity work.

Many active land mines still remain from World War II battles along the Mediterranean coast, representing a hazard and a nuisance to exploration work.

Libyan American Oil Company may be the first to drill in Libya.

The recent oil discovery in the Sahara desert of Algeria by CREPS (see Algeria), less than two miles from the southwest Libya border, was not expected to affect Libya much. Production is from the Pennsylvanian, and most of the newly-enhanced Carboniferous basin lies in Algeria, though a portion of it lies in extreme west and southwest Libya. The discovery has no effect on possibilities along the Mediterranean coast.

Gambia. D'Arcy Exploration Company is active in Gambia, westernmost British protectorate, on the coast. A waterborne seismic survey of more than 200 miles of the River Gambia was conducted by Geomarine Service International in 1955 from the vessel *Sonic*, and surveys of land presumably will follow.

Nigeria. Shell D'Arcy Petroleum Company of Nigeria Ltd., Inc., consisting of Royal Dutch Shell and British Petroleum Company Ltd. interests on a 50-50 basis, is continuing exploration that has been pursued since 1937. Some gas was found in a well at Akata during 1954.

In March, 1955, a wildcat at Akukwa in Onitsha province blew out, but was later abandoned. A deep test was drilled to 12,046 feet and

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You can soon pay the initial cost of installing the Enardo Clock by saving the return trips necessary to check installations.

The Model "W" Clock is designed to control the flow of low pressure gas or liquid and to shut off the supply at a predetermined time, with a positive bottle tight seal. Valve will function at operating pressures up to 100 p.s.i.

The Enardo "MB" and "A" time cycle switches are designed to control electrical circuits on pumping engines and other equipment. They will shut-down the engine at any number of hours, up to 22 hrs. on the 24 hr. model; and 11 hrs. on the 12 hr. model. All clocks are manually wound and set.

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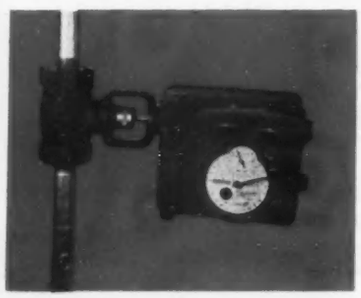
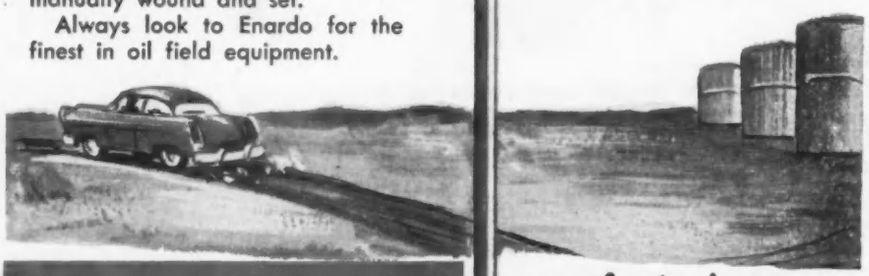


"W" Clock Shut-Off Valve



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E. O. Buck, *Vice President, Oil Loan Department.*

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have been found at Ituk Mbang, and at Ekim in Calabar province. Though more than $31 million has been spent in Nigeria for exploration without any return, prospects appear fairly good. They are also enhanced by the apparent discovery in the nearby Cameroons.

Gold Coast. A Gulf Oil Corporation subsidiary will explore a 200-square-mile concession area in western Nzime State in accord with two recent 99-year leases between Gulf and the Gold Coast government. The two leases provide for 100 square miles each, one onshore and one offshore.

Tanganyika. D'Arcy Shell Development Company drilled a deep test on a seismic prospect on Mafia Island, just off the Tanganyika coast, and abandoned the well at 11,051 feet late in 1955. The rig was moved 100 miles north to Zanzibar island, where another deep test was being readied in 1956, located ten miles north of Zanzibar town.

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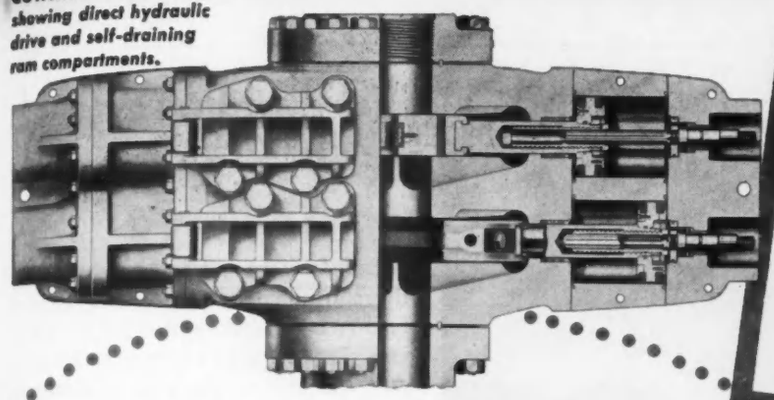
Ethiopia. Sinclair Petroleum Company drilled seven exploratory tests in 1955, ranging in depth from 1289 feet to 5990 feet, totaling 26,141 feet of hole. No return was yet indicated from Sinclair's exploratory effort, which began in 1945 when the concession was granted. However, in Somalia, Sinclair Somal Corporation was conducting surface geological and seismograph work, and brought a rig capable of 15,000 feet into the country in April, 1956. On June 21, Sinclair Somal spudded Gira 1, first test on its 56 million-acre concession in Somalia, located 27 miles west of Obbia on the Indian Ocean. Rig is capable of about 15,000 feet. International Drilling Company is the contractor. AGIP, exploration arm of Ente Nazionale Idrocarburi (ENI), the Italian government oil monopoly, brought drilling equipment into their northern Somalia concession area late in 1955 and commenced drilling in 1956.

Italy's present administration of Somalia under United Nations trusteeship will expire in 1960.

British Somaliland. Conorada Petroleum Corporation continued exploration with one seismic and two geological parties on its 36,000-square-mile concession that adjoins Somalia to the southwest. Standard-Vacuum Oil Company completed taking over rights to a 11,380-quare-mile concession previously held by Moriqui Exploration Company. Preliminary geological work has progressed rapidly, and seismic surveys were programmed for 1956.

Madagascar. Societe des Petroles de Madagascar (SPM) has a 66,000-square-mile concession covering roughly the western third of the island. During 1955 two wells were drilled, and a third was drilling at the end of the year. Total 1955 footage drilled was 12,600 feet. Considerable gravity and refraction seismograph work had been completed.

The Sikily test, completed in 1955, went to 8991 feet, bottomed in Jurassic beds, and found some shows of gas. Gas shows were also reported in the two other 1955 shallower tests, drilled near Ranohira and d'Ankazoabo, according to *Le Journal des Carburants.*



CUTAWAY VIEW
showing direct hydraulic drive and self-draining ram compartments.

Feature by Feature

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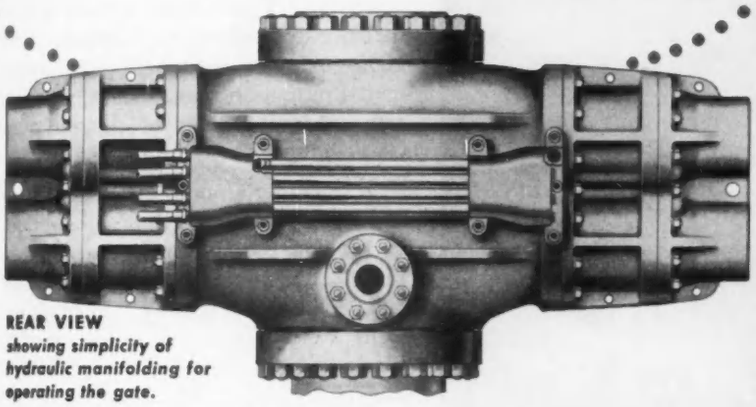

REAR VIEW
showing simplicity of hydraulic manifolding for operating the gate.

What do *you* value most in cellar control gate equipment? . . . Compactness? . . . Convenience? . . . Simplicity? . . . Safety? . . . Versatility? In Shaffer Hydraulic Cellar Control Gates you get all these—and more—to a degree unsurpassed by any other equipment. Compare—point by point, feature by feature—the *extra* values you get in Shaffer equipment, and you'll know why they are the choice of so many leading operators . . .

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is probably the most important feature to look for in any pressure-protection equipment, and in Shaffer Hydraulic Gates you get safety backed by the organization that pioneered cellar control gates more than three decades ago. Successful from the first gate built, Shaffer Gates have nevertheless gone through a constant program of development to always keep ahead of the industry—and are today accepted as standard throughout the oil world.

SIDE DOOR RAM CHANGES

With Shaffer Hydraulic Gates there's no need to dismantle the gate each time the rams are changed. You simply open two doors in the side of the body, slide out the ram assembly, change rams, replace the assembly and bolt the doors shut. Closing the doors automatically aligns the rams within the body.

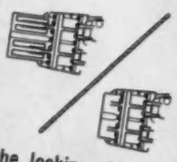
There's no need to allow extra room above the gate or at the ends to change rams—and complete ram changes can be made whether the pipe is **in** or **out** of the hole!

THREE-WAY COMPACTNESS

Space saved in the cellar is particularly valuable space. It means lower rig-up costs, smaller cellar requirements, simpler connections . . . and you save important space with Shaffer Hydraulic Gates. In all three dimensions—height, width and length—Shaffer Hydraulic Gates are unusually compact!

Even in sizes as large as 13⅜" (12" Series 900) Single Gates require only 18½" total height—Double Gates (two compartments in one body) only 30". There's no need for extra room above the Gates—nor need the compact length dimensions be expanded endwise—to permit ram changes.

RISING or NON-RISING SHAFTS



Whether you prefer the extra compactness of a non-rising shaft or the quick indication of ram position afforded by a rising shaft—you get the design **you** prefer from Shaffer. In both designs, built-in body extensions protect the locking shafts against damage in all positions—extended or retracted!

SELF-DRAINING COMPARTMENTS

No detrimental sand or mud accumulations can interfere with free ram travel when you use Shaffer Gates. Note how the rams travel on high guide ribs above the steeply-sloped gate bottoms which quickly drain mud and sand back into the well. Also, since well pressure is free to flow to the back of the rams, it actually assists in the closing and sealing action.

Get the full story

on these and many other Shaffer advantages before you invest in any pressure control equipment. And for those who prefer mechanical operation, Shaffer also provides a complete line of Double and Single Mechanical Cellar Control Gates with rams that are interchangeable, size for size, with those in Hydraulic Gates. This saves on inventory, simplifies maintenance where both types are used. See your nearest Shaffer representative for complete details—or write direct.

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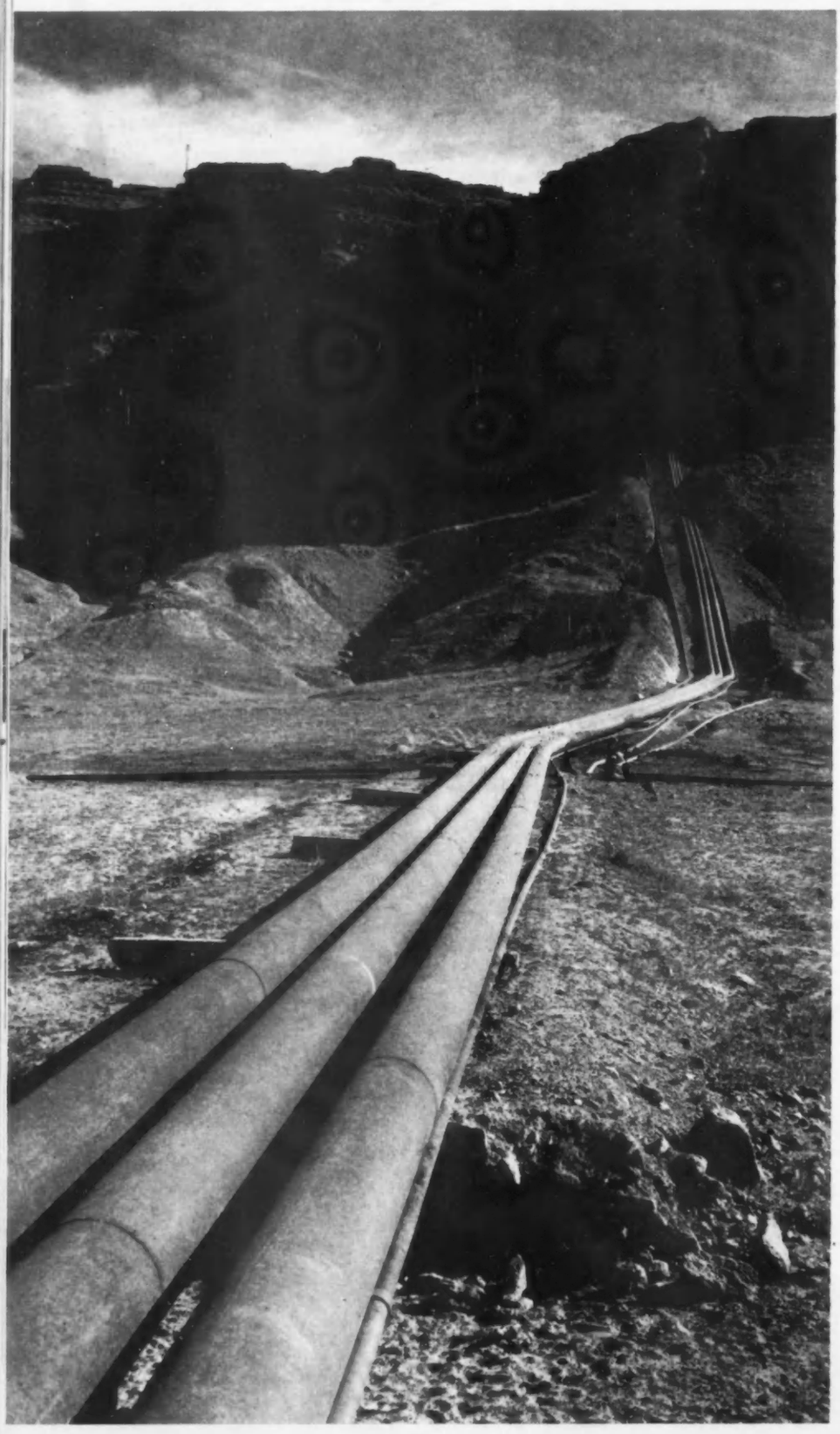
Iran . . . On road to recovery . . . shoots for 637,500 bpd by '57.



An oil pipe line in the hilly country of Agha Jari.

IRAN'S VAST oil industry, virtually dormant during the three-year dispute following nationalization in 1951, ended a full year of progress in 1955 and was well on the road to recovery. A program agreed upon by the Iranian Consortium and the Iran government called for production of 327,500 barrels daily in 1955, 500,000 barrels per day in 1956, and 637,500 barrels daily, the peak of previous production set in 1950, during 1957.

Early in 1956 the government asked the Consortium to expand production at an even faster rate than agreed upon. The Consortium said it would make every effort to expand. The 1955 goal, was, for practical purposes, met. Production was rising at a rapid rate, and all phases of the industry were being put in order and/or expanded.

Production. Total crude production in 1955 in the Consortium areas was 119,002,000 barrels, or an average of 326,033 barrels a day. Thirty-nine wells were producing crude at the year's end. No new wells were drilled during the year. The number of oil wells shut in at the year's end was 52.

In August, 1955, production was running well ahead of the average set for the year, with 353,600 barrels a day being produced. The Agha Jari field was producing more than three-fourths of the total, with 269,000 barrels daily. Following Agha Jari were Masjid-i-Sulaiman, 34,000 barrels daily; Haft Kel, 33,000 barrels; Naft Safid, 12,000 barrels; and Lali, 5600 barrels a day during August. Gach Saran was not on production.

Outside the Consortium area, production by the Iranian government, purchased from The British Petroleum Company, Ltd., and now operated by National Iranian Oil Company at Naft-I-Shah field on the Iraq border, was running at about 3300 barrels daily. Production is shunted through a high-pressure 3-inch pipe line to a small refinery at Kermanshah, about 100 miles to the east. The products are consumed locally.

The date of the agreement between the government and the Consortium was Oct. 29, 1954, and oil production

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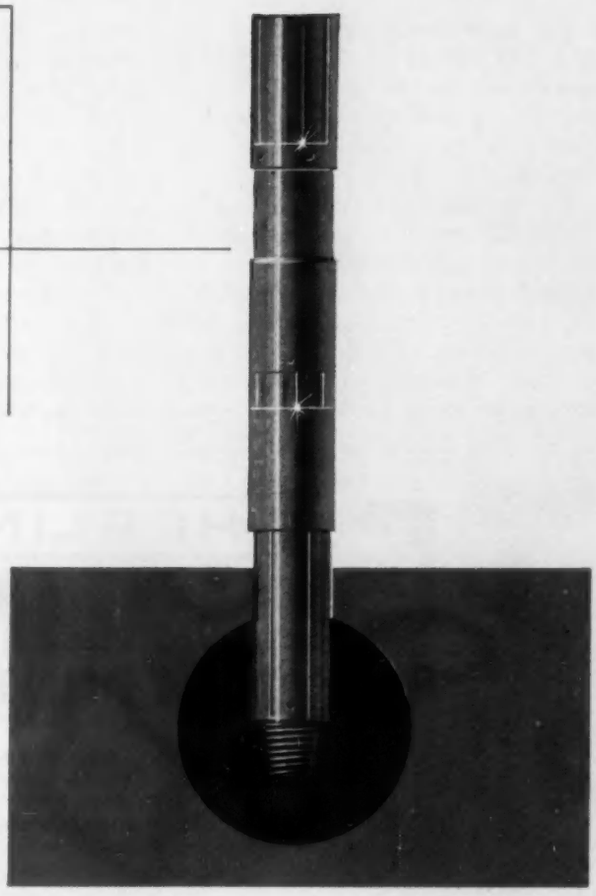
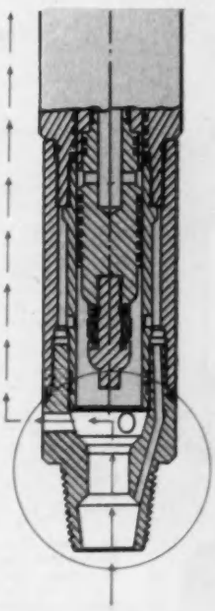


A reliable test is of vital importance, affecting decisions as to further development and completion. That's the kind you get... quickly and easily... with Halliburton's HYDRO-SPRING TESTER.

The locked-open By-Pass allows tools to be lowered with speed and ease and helps to eliminate damage to formation and packer. This important feature is especially helpful in getting the packer on bottom with a minimum of packer drag or drill pipe spudding.

AIDS AGAINST FORMATION BREAKDOWN

The By-Pass aids the packer in squeezing through tight spots caused by filter cake and thus reduces pressure build-up below the packer. It also helps prevent the forcing of mud into the formation being tested. Pressure is equalized above and below the packer until the Hydro-Spring Tester opens.



TIMED ACTION HELPS PREVENT PREMATURE OPENING

The Hydro-Spring Tester is opened by setting down weight... and closed when weight is removed. However, a *time interval*, determined by the amount of weight set down, helps prevent premature opening of the tester, particularly if a bridge is hit. This also allows the packer to expand before the tester opens. At the end of the time interval, the tester valve opens quickly and completely. It closes immediately when weight is removed. Picking up weight causes the By-Pass Valve to open, equalizing fluid to ease both packer and string removal with a minimum of lost time and difficulty, and with less strain on the derrick.

When that critical time arrives and the well is ready for test, you want to know its potential quickly and accurately. Halliburton's Hydro-Spring Tester helps you arrive at decisions for further development with the satisfaction that comes when you know you have the most reliable test. It's one of the many reasons why Halliburton's *best for your drill stem test.* For all the reasons, just phone your local or division office of the Halliburton Oil Well Cementing Company.

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began immediately thereafter. From then till the end of 1954, 6,780,000 barrels was produced by the Consortium, equivalent to 109,355 barrels daily. The 1955 producing rate was three times greater.

Iranian Oil Exploration and Producing Company, an integral part of the Consortium, commenced work on a development program early in 1956. In Agha Jari and Naft Safid fields, new wells were to be drilled, and production units, pipe lines, and roads were to be built. A new gas-oil separator unit, with a capacity of 157,000 barrels daily, entered service at Agha Jari field in July, 1955. Another unit, which will be the fourth in the field, was scheduled.

Agha Jari Well 36 was spudded Jan. 18, 1956, and additional drilling will be done to define the northwest limits of the field. At Haft Kel field, well workovers were begun in 1956.

Agha Jari 36 was completed at 6300 feet as an oil well, and plans were made to drill Well 38. Wells also were projected in mid-1956 at Naft Safid, and plans were made for a 10,000-foot wildcat near Ahwaz on the Qarait structure.

Santa Fe Overseas Drilling Company is doing the drilling for the Consortium, with six Americans and 40 Iranians composing the drilling personnel.

By May, 1956, crude production had reached 556,000 barrels per day, exceeding the 1956 goal of the original 1954 agreement by almost 60,000 barrels.

Pipe Lines. Much work has been done in the overhauling of 2000 miles of pipe lines between the oil fields, Abadan refinery, and the port of Mashur. For instance, 11 miles of 16-inch line between Agha Jeri and Mashur had been disrupted by a flood, and had to be replaced. About 50 miles of secondary lines have been built in the oil fields, and an Agha Jari-Abadan crude line has been converted to a gas line which is being used as fuel at the plant.

As of June 3, 1956, 180 miles of a 10-inch crude products line, being built along the 570-mile railway and highway route from Ahwaz to Teheran, had been completed. The line was being built by the government to supplement the overburdened railroad in supplying needed products to central and northern Iran.

Four pumping stations also were under construction. The $32 million project will have a capacity of 40,000 barrels daily. Costain-John Brown, Ltd., of London, prime contractor, was building the 340-mile section from the south end, with Williams Brothers of Tulsa, Okla., consultants for this portion. Societe Entrepose, of Paris has the contract for the northern section.

This line is a particularly difficult one since it crosses the Zedran mountains at elevations above 10,000 feet. With the possible exception of some crude lines the Chinese Communists may have built in Chinghai and Sikang provinces in their far west, the Ahwaz-Teheran project is probably the highest pipe line in the Eastern Hemisphere.

Refining. An average of 152,000 barrels daily was run to stills at Abadan during 1955. The capacity of the refinery was 500,000 barrels daily in 1955, but there appeared to be no particular urgency to push the throughput up to that mark in the

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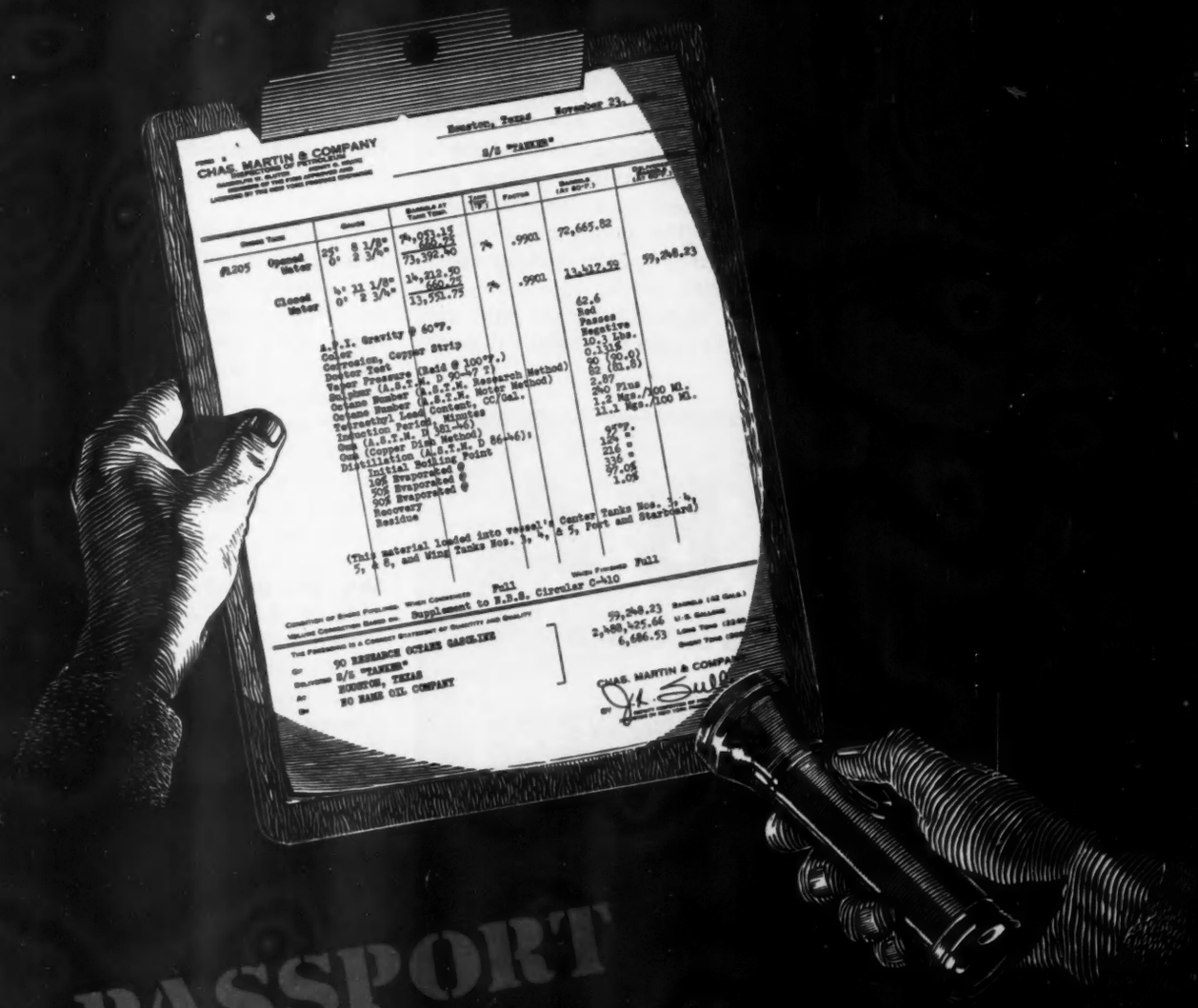

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near future because the government is emphasizing crude export. A big boost in refining capacity currently is a secondary objective.

The Abadan refinery never was shut down completely, as it supplied Iran's needs during the period of nationalization. The Iranian Oil Refining Company, the refining arm of the Consortium, made a careful study in November, 1954, immediately after the agreement was concluded, and began to recondition some units. A general overhaul of the plant is in progress, with 4500 men working on it. About two more years will be required to finish the job.

Maintenance and construction work also was under way. Distribution systems, power plants, river-craft overhaul, air-conditioning, and a host of other relatively routine projects currently are keeping a force of 16,000 men busy. The number of employes actually employed in refining operations is 4200.

Three large distillation units currently are in operation. Daily throughput is 210,000 barrels of crude, yielding mostly middle distillates and fuel oil. Two vacuum distillation units are producing lube oils for domestic consumption. A bitumen plant fulfills domestic needs, which are rising sharply due to increased road-building in Iran, and provides a surplus for export.

Considerable aviation gasoline now is being produced, with isomerization and alkylation units operating. A big cat cracker, with a 30,000-barrel daily capacity, has been in operation since its overhaul was completed on Nov. 5, 1955.

Average daily throughput at Abadan for May, 1956, was 229,000 barrels, and the average for the first five months of 1956 was 203,140 barrels a day.

Shipping and Exports. About two-fifths of Iran's crude production is refined at Abadan, the shipping point for product exports. Crude is exported from Bandar Mashur, and emphasis is being placed on expanding the port. Two jetties existed before 1955, a third was completed in February, 1955, and the fourth came into use in March, 1956. Supplementary storage and pumping facilities have been installed, and construction of a fifth jetty was planned. Bandar Mashur port now can handle 50 big tankers monthly, and expansion will enable handling even more.

Consortium members are hard put to find new markets for Iranian oil, in view of the great changes that have taken place during the past five years —particularly in the big boost in crude production from Kuwait and other Middle Eastern countries and in the mammoth refinery construction and modernization programs that have developed, particularly in consumer countries.

This explains the emphasis on crude exports, and, though product exports, too, are a big source of revenue, which is really the goal of both the Consortium and the government, Abadan's capacity is being rebuilt selectively. Refining has changed much in its emphasis on new products and more modern units since 1951, and Abadan, therefore, must change also.

New Equipment. An interesting development is the installation of two

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4000-kw gas turbine generators at Masjid-i-Sulaiman field. These two units were installed, one in September, 1955, the other in February, 1956. Natural gas is the fuel used, piped via a new line from Naft Safid, 22 miles distant. Locally-produced gas is too sulfurous for fueling the turbines.

Revenues. Between March, 1955, and March, 1956, Iran received $98 million dollars from oil exports, and the nation's annual income within two years is expected to reach $188 million, about equal to all Iran's other income sources combined. Other benefits include employment of 50,000 Iranians in the oil fields.

The Imperial Government of Iran, together with the National Iranian Oil Company, entered into an agreement, signed on Oct. 29, 1954, with a group, now called the Consortium, consisting of a number of international oil companies.

Five major U. S. companies, each with a 7 percent interest, are members of the Consortium: Standard Oil Company (New Jersey), Gulf Oil Corporation, Standard Oil Company of California, The Texas Company, and Socony Mobil Oil Company.

Nine other U. S. companies jointly own 5 percent interest: American Independent Oil Company, Hancock Oil Company, Atlantic Refining Company, Getty Oil Company, San Jacinto Petroleum Corporation, Richfield Oil Corporation, Signal Oil and Gas Company, Tide Water Oil Company, and Standard Oil Company (Ohio).

The remaining 60 percent interest is shared by The British Petroleum Company Ltd., 40 percent; Royal Dutch Shell, 14 percent; and Compagnie Francaise des Petroles, 6 percent.

All companies or groups mentioned were original signatories to the agreement, and most of them have since transferred their rights to subsidiary companies. Two companies were formed by the Consortium to operate in the area governed by the agreement, which includes the known fields of South Iran. These companies are Iraanse Aardolie Exploratie en Productie Maatschappij (Iranian Oil Exploration and Producing Company) N V and Iraanse Aardolie Raffinage Maatschappij (Iranial Oil Refining Company) N V, both with home offices in The Hague, Netherlands.

Iranian Oil Participants Ltd., a British firm headquartered in London, also was formed by the Consortium as a holding company governing the shares of the two operating companies, proportioned according to the interests of each member company of the Consortium.

The 1954 agreement effects a partnership between the Consortium, and the Iranian government and its agency, National Iranian Oil Company, owner of the oil reservoirs and of the oil field and refining equipment. The two operating companies of the Consortium, thus, are in charge of producing the oil within its area, refining it, and marketing that which is exported. The National Iranian Oil Company markets within Iran, and carries out all phases of the business outside of the Consortium area. Eventually, NIOC will assume responsibility for all supporting services (e.g., hospitals and clinics) within the Consortium area as well.

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At Banias, Syria, samples of oil are taken from a storage tank. During 1954 more than 127 million barrels of oil were exported from Banias.

Iraq . . . Entire country under concession. Basrah expansion helps boost production almost 8 percent.

ORDERLY DEVELOPMENT and expansion of Iraq's oil industry continued in 1955 and 1956. Crude production reached 246,479,050 barrels in 1955 for an average yield of 675,285 barrels daily. This amounted to an increase of 18,011,464 barrels, or 7.88 percent, over 1954 production. The rise was due primarily to expansion of Basrah Petroleum Company's facilities. Eight new oil wells were completed in the Rumaila field, first discovered in 1953 and put on production in 1954. Basrah's production rose steeply from 95,051 barrels daily in 1954 from Rumaila and Zubair fields in far southern Iraq to 150,146 barrels daily in 1955, an increase of 55,095 barrels per day, or 58 percent above 1954 production.

Four companies are operating in Iraq, three of them affiliated, and the entire country is under concession. Iraq Petroleum Company, Ltd., operates in the northeastern part of the country, bordering the Tigris river on the west, the Turkish border on the north, and the Iran frontier on the east, with the exception of a small concession at Chia Surkh operated by Khanaqin Oil Company, Ltd., which is contiguous with former Anglo-Iranian Oil Company holdings in Iran.

Khanaqin is affiliated with The British Petroleum Company, Ltd.

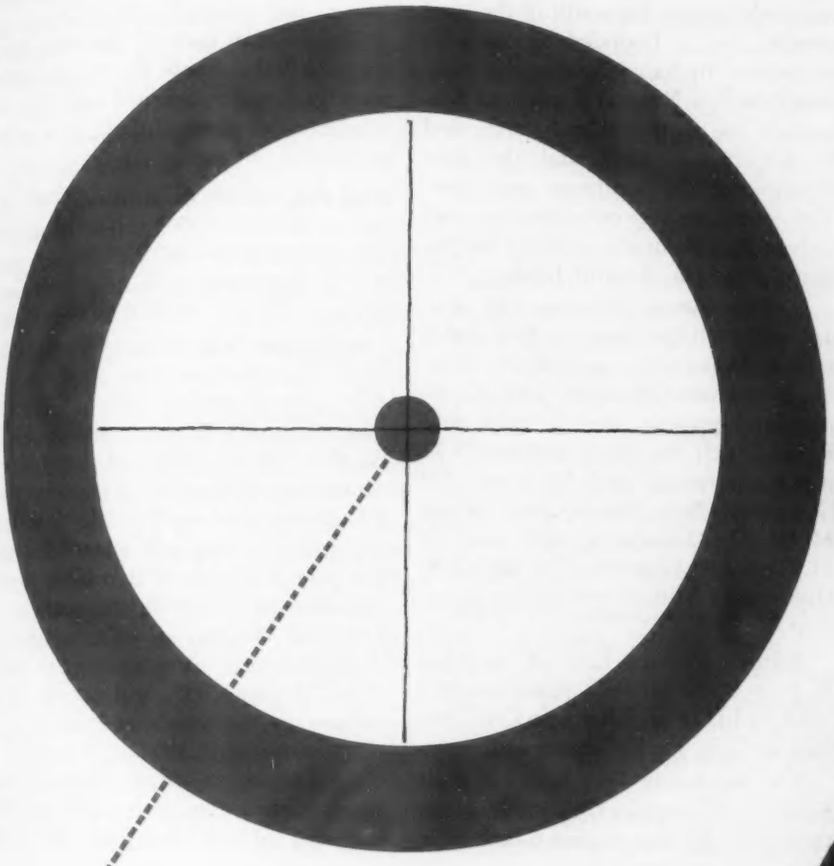
Iraq Petroleum operates Kirkuk, Bai Hassan and Jambur fields, all in the Kirkuk vicinity.

The two other companies, Basrah, and Mosul Petroleum are affiliates of Iraq Petroleum. Mosul's concession takes in the northwestern part of Iraq, bordered by the Tigris river on the east, by Syria and Jordan on the west, and by the 33rd parallel of north latitude on the south, meeting the Tigris river 30 miles southeast of Baghdad. Mosul's production is from Ain Zalah and Butmah fields on the west bank of the Tigris in the far northwest, near the point where Iraq, Syria, and Turkey have a common corner.

Basrah Petroleum's concession, the

Photos courtesy of Iraq Petroleum Company, Limited

Instructor checks the work of a trainee in the training workshop at Homs, Syria.



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Rolling Rumaila Rig No. 1 by bogie.

country's largest, lies south of the 33rd parallel, and is bounded on the west by Jordan; by Saudi Arabia, the Iraq-Saudi Arabia Neutral Zone, and Kuwait on the southwest and south; and by the Persian Gulf and the Iran frontier on the southeast and East. The company's production is from Zubair and Rumaila fields in the far south, near the Kuwait border.

Iraq Petroleum Company, Ltd., and its two affiliates have a thoroughly split-up ownership, as follows: British Petroleum Company, Ltd., Compagnie Francaise des Petroles and Royal Dutch Shell each holds a 23.75 percent interest; and Standard Oil Company (New Jersey) and Socony Mobil Oil Company each has an 11.875 percent interest. The late C. S. Gulbenkian held the remaining 5 percent.

Another intricate facet of the setup in Iraq is the oil field straddling the border of Iran on Khanaqin Oil Company's Chia Surkh concession.

The portion in Iraq is called Naft Khaneh. Production from there is run through a 30-mile, 4 and 6-inch pipe line to the Alwand refinery.

The Iranian part of the same field is called Naft-i-Shah. Production from there is run through a 3-inch line to a refinery at Kermanshah, 115 miles to the east, in Iran.

Iraq Petroleum Company. IPC produced 178,765,320 barrels of crude during 1955, or 489,768 barrels per day, a slight drop from the 1954 production rate of 493,411 barrels daily. The Kirkuk field, 52 miles long parallel to its structural axis, produced its 150 millionth ton of crude in October, 1955. Kirkuk was discovered in 1927. At the end of 1955, 44 wells were producing at Kirkuk. There were also 19 observation wells, 15 oil-water, three gas-oil, and one water observation well. Another well was temporarily abandoned during the year.

At Bai Hassan, 10 miles southwest of Kirkuk field, three wells were completed during 1955, and another was drilling at the year's end. This field was discovered in 1953.

At Jambur, a 1954 discovery, located eight miles due south of the southern tip of Kirkuk field, four wells

were completed during 1955, and two more were drilling at the year's end. Construction of a 36-mile, 20-inch pipe line to link the field to the Kirkuk network, and of a temporary degassing station, was completed during 1955 in order to put the promising new field on production.

IPC's drilling footage was 41,024 feet during 1955, more than double the 1954 figure of 18,786 feet.

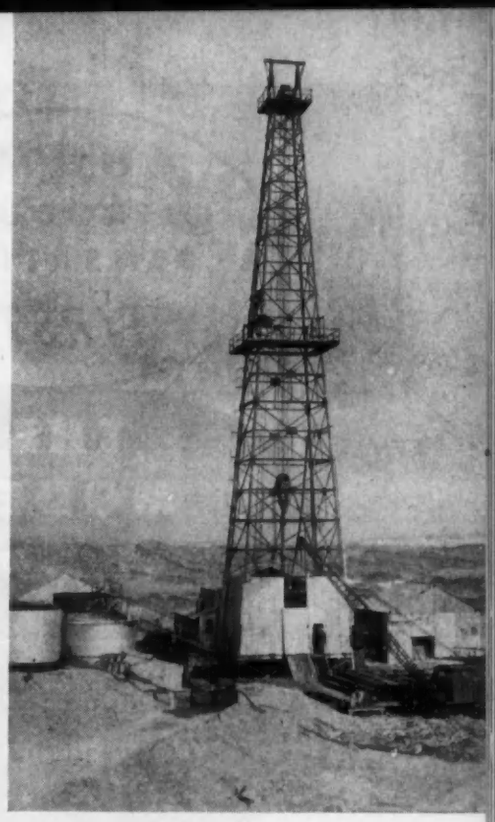
Basrah Petroleum Company. Basrah Petroleum's production during 1955 rose to 150,146 barrels daily as previously stated, from Rumaila and Zubair fields. Footage drilled amounted to 71,821 feet, down 19,533 feet—21 percent—from 1954's 91,354 feet of hole. Drilling was confined to the Rumaila field, a 1953 discovery. Eight new wells, several of which had been commenced in 1954, were completed in 1955, bringing the field's total to 13 wells.

Increased production from the Basrah (Rumaila-Zubair) vicinity has necessitated expansion of Basrah Petroleum's facilities. At Fao terminal on the Persian Gulf, six new storage tanks were finished, bringing the total there to 18. Four more were being built at the year's end.

Shallow water also is a problem at Fao. Existing facilities currently cannot accommodate tankers with much greater draft than the T-2 (a 15,000-ton vessel). A proposal to build an artificial island off Fao with loading facilities for supertankers, connected by submarine pipe line to the shore was being considered in 1956. An alternative proposal was to build a new pipe line from Zubair and Rumaila through northeastern Kuwait to a coastal point between Kuwait town and Mina al Ahmadi. The Sheik of Kuwait granted permission to IPC to survey the proposed pipe line route, according to a report in March.

Mosul Petroleum Company. Mosul Petroleum's 1955 crude yield amounted to 9,510,440 barrels, or 26,056 barrels daily—an increase of 153 barrels daily over 1954's 25,903 barrels a day, or less than 1 percent change.

Ain Balah field produced three-fourths of the total, and Butmah the



Photos courtesy of Iraq Petroleum Company, Ltd.
At Jambur, 35 miles southeast of Kirkuk, 21 miles of access roads were made through difficult country to Wells No. 3 and 4 and to other sites selected for drilling.

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remainder. Drilling footage rose to 27,288 feet, a big 51 percent jump over the previous year's 18,019 feet of hole.

Two rigs were drilling at the end of 1955, one each at Jebel-Makhul and Sasan. A test at Atahan was abandoned at 11,312 feet, and a second test there was being drilled below 9000 feet with some slight oil shows at that depth.

By March, 1956, the wildcat on the Sassan structure, 25 miles southwest of Ain Zalah field, had showed for oil production. The test encountered high-gravity oil at 5000 feet.

Khanaqin Oil Company. During 1954, production from Naft Khaneh amounted to 11,570 barrels daily from two wells, with two others shut in. The same two wells were reported producing over 12,000 barrels daily during mid-1955. One well reportedly was producing at the year's end. Production during 1955 is estimated at about 3,400,000 barrels or 9315 barrels per calendar day. No drilling activity was reported, but an active seismic exploration program was being conducted by Khanaqin during 1955 and 1956. A deep test was being drilled in Naft Kaneh field and had reached 5000 feet in April, 1956. Favorable oil shows were reported below that depth.

The Alwand Refinery was sold by Khanaqin several years ago and is operated by the Iran Government.

Goal Exceeded. Production from the Kirkuk and Mosul regions, which averaged 515,824 barrels in 1955, is clearly in excess of the goal of 460,000 barrels per day agreed upon by IPC and the government in 1951. At the same time, Basrah's production goal was set at 165,000 barrels per day, which was not quite met in 1955 since the average figure for the year was 150,146 barrels per day. However, with the development of Rumaila field and the construction of new facilities at Fao, this goal was expected to be exceeded in 1956.

Refineries. Rated capacities as of Jan. 1, 1956, of IPC's refineries, were as follows:

- Kirkuk—atmospheric distillation, 2880 barrels per day, and 565,000 barrels daily crude oil stabilization capacity.
- Tripoli, Lebanon—11,550 barrels daily, all atmospheric distillation.
- Haditha—6450 barrels per day,

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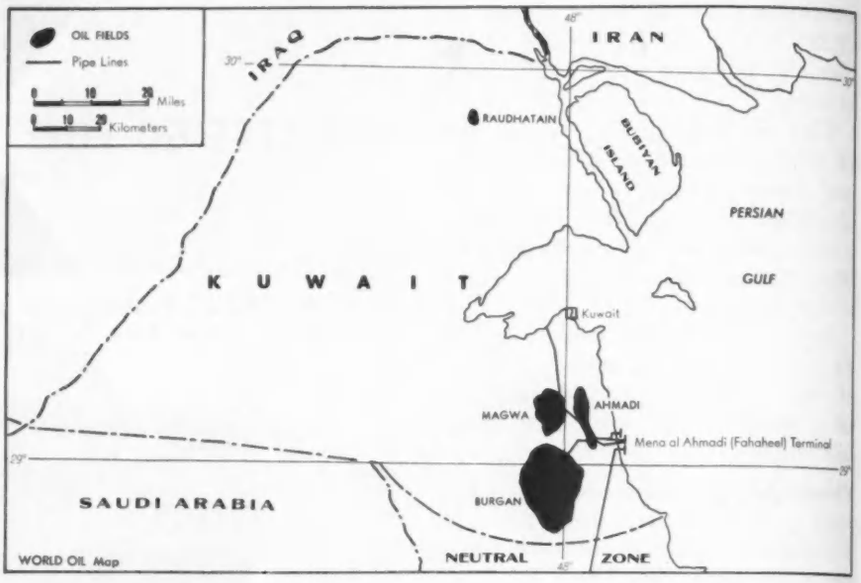
- The Alwand Refinery is rated at 10,250 barrels daily.
- Basra—depot plant at 3250 barrels per day.

During the summer of 1955, the Iraq Government's new Dora refinery went on stream near Baghdad. The new plant was designed to run 25,000 barrels daily of royalty crude from IPC moved via a 12-inch pipe line connected to production facilities to the northwest.

Pipe Lines. In addition to projects mentioned previously, Basrah Petroleum completed a 20-mile, 14½-inch crude line to connect Rumaila field with existing crude-gathering facilities in Zubair field.

Failure to reach agreement on negotiations between IPC and the Lebanese government on pipe line royalties to be paid to the latter was holding up projected pipe line facilities expansion between Kirkuk and Tripoli, Lebanon.



Iraq Petroleum Company reportedly has been granted permission to survey a proposed pipe line route from the Basra-area fields across northeastern Kuwait to a coastal point between Mena al Ahmadi and Kuwait town.

Kuwait . . . Production outdistances Saudi Arabia's. Important well completed near Iraq border.

THE SMALL Sheikdom of Kuwait recorded a banner year in 1955. Crude production amounted to 398,493,597 barrels, or an average of 1,091,763 barrels per day—an increase of 14.66 percent from 1954 production of 347,557,492 barrels, or 952,212 barrels daily. The increase in 1955 was 50,936,105 barrels.

Compared with Saudi Arabia, Kuwait regained the production lead that it held over its big southern neighbor in 1953 and relinquished in 1954. Arabian American Oil Company's production in 1955 was 965,041 barrels daily, having increased 12.6 percent from 1954. But Kuwait boosted production by even a larger percentage and reported a 126,722 barrel-a-day margin over Saudi Arabian production during 1955.

Total production reported during the first five months of 1956 was 178,605,549 barrels, or 1,175,037 barrels per day, a 7 percent increase over the first five months of 1955, and 135,121 barrel-a-day margin over Saudi Arabian production during 1955.

But even this big production news took a back seat to the very important discovery completed by Kuwait Oil Company, Ltd., sole concessionaire to Kuwait's onshore territory, at Raudhatain, in North Kuwait. The well was very interesting from the start, the rig having been moved over a 100-mile skidway from Ahmadi field to the location. Drilling operations took about a year, the well being completed in November, 1955, at total depth of 10,301 feet.

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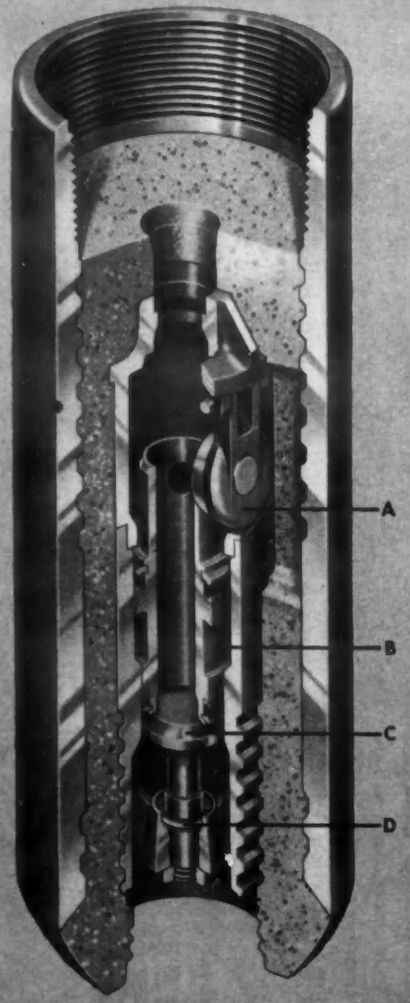

A Flapper Type Back-Pressure Valve activated at option of operator.

B Sleeve Valve, **C** Sleeve Valve Seat — Control rate of flow and volume of fill-up fluid.

D When operator shears this Shear Ring (1,000 psi on casing), Flapper Valve is released to form a Back-Pressure Valve for floating or cementing.

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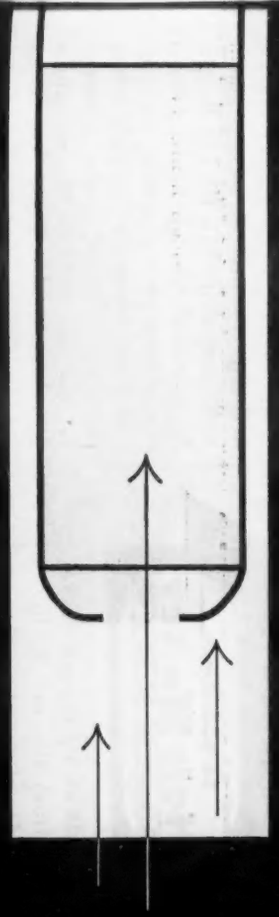

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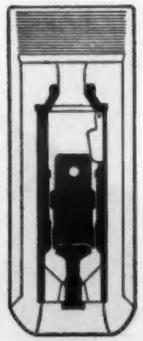
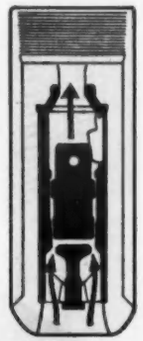
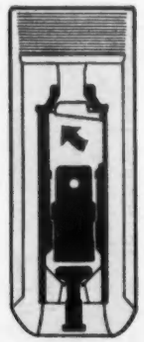


RUNNING-IN
Sleeve Valve in closed position



RUNNING-IN
Sleeve Valve in opened position



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Flapper Valve released

Hydrostatic pressure of the "fill" acts on the upper pressure area of the sleeve valve. Hydrostatic pressure of the fluid in the annulus acts on the lower pressure area of the valve which is 90% of the upper pressure area. It is this differential in area that results in a "fill" of approximately 90% (shoe or collar), or 81% (shoe and collar) with respect to the fluid level of the annulus and gives the equipment its name. The valve opens and closes in accordance with the pressure differential across it to: (1) fill the casing automatically, (2) reduce pressure surges and (3) prevent overfill of the casing.

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testing that apparently was done to evaluate the pays found. By mid-1955, reports that the well had proven successful in the Burgan sands which, 65 miles of south of Raudhatain, are prolific at moderate depths (about 4000 feet) were heard. After drilling operations were completed in November, unofficial reports persisted that oil pays at Zubair and Rumaila fields, 40 miles northwest of Raudhatain across the border in Iraq, also were proven oil-productive at Raudhatain. No report had been heard that gave the new well less than 1200 feet of pay section.

The Gulf Oil Corporation 1955 annual report states that ". . . the exploratory well started in 1954 near the Iraq border . . . encountered a number of oil-bearing zones, both in the formations productive at Burgan and in the deeper pays producing in the nearby Iraq fields. Production tests had been completed at the end of the year and unquestionably established that another major oil field has been found . . . Drilling of a second well, about two miles from the discovery well (actually 1.8 miles southeast of it) is now under way."

Gulf Oil Corporation and British Petroleum Company, Ltd., own Kuwait Oil Company on a 50-50 basis.

Actually, the discovery should not be so surprising, since the location was more than well selected. It is on trend with Burgan and Magwa fields in Kuwait and Wafra field in the Kuwait-Saudi Arabia Neutral Zone, and it is part of a prolific general Cretaceous trend that carries all the way down the western shore of the Persian Gulf through Aramco's offshore Safaniya field, through Bahrain Island and even farther south.

Since the Raudhatain discovery, it is difficult to see how Kuwait's crude reserves could be less than 35 billion barrels. Some estimates, since publication of the now-famous McKinney report in which Wallace E. Pratt estimated Middle East crude reserves at 230 billion barrels, put Kuwait's share at as much as 70 billion.

On a more local level, the area along the Iraq-Kuwait border is very much enhanced. In Iraq, no wells were drilled at Zubair field in 1955, but eight wells, all successful oil producers, were drilled at Rumaila. It is possible that one or more oil fields will eventually straddle the border as development of the area continues.

Whether the Raudhatain discovery is examined from a local, regional, or reserve-wise standpoint, the outlook for big oil was very bright.

Drilling. Twenty-two development wells were drilled in 1955 in Burgan, Magwa and Ahmadi fields. Twenty-one of these were successful, the other, a dry hole, being the first failure since the first test drilled in the country at Kuwait Bay in 1936. The second test drilled in Kuwait found the Burgan field in 1938.

The Raudhatain test was the only wildcat drilled in Kuwait in 1955.

Total number of oil wells at the end of the year was 191. Of these, 185 were connected and on production. Three rigs were running, 3 engaged in development work and 1, which worked at Raudhatain. Seven producers were drilled at Burgan, and 14 producers and 1 dry hole were drilled in the Magwa-Ahmadi area. One rig was engaged in workover operations during half the year.

Pipe Lines and Refining. During 1955 an existing 20-inch transit line was extended, and a new 30-34 inch line was built, both to assist crude oil transmission from Burgan field to

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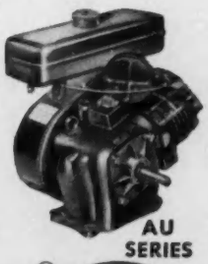

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4. Truck bed, winch, complete winch drive including power divider, quickly removable as a single unit for inexpensive remounting.

5. Choice of platform or ground controls, with the truck clutch and transmission gear shift controls conveniently located at operator's position.

6. Full air friction drum clutches are self-adjusting, smooth operating, have long lining life and each has ample capacity for maximum rated line pulls.

7. No reeving sheave required, drums positioned so lines go direct to mast crown, better spooling, less line wear and less maintenance.

8. Simplified maintenance — prelubricated, sealed bearings used where possible, grease fittings located on exterior of frame for easy access, sectional cowling quickly removable.

9. Brakes — removable rims, center anchored — dead-end equalized, self-energized, smooth and powerful holding action, positive release, one point adjustment.

10. Ample clear bed space for tools and equipment.

11. Complete accessory equipment for single and double drum models, including single or twin pole pipe mast, telescopic derrick, rotary drive, etc.

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Ahmadi. Four new storage tanks, of 210,000 barrels capacity each, were completed at Ahmadi.

The Mina al Ahmadi refinery ran almost at peak capacity all year, as an average of 29,445 barrels of crude was charged daily. The current capacity is about 30,000 barrels per day. Thus, 2.7 percent of indigenous crude production was refined in Kuwait during the year.

But the records being set in production, exploration and reserves development in Kuwait do not obscure new refining developments. Early in 1956, Kuwait Oil announced that the Mina al Ahmadi plant would undergo an expansion, one of the biggest in refinery expansion history. Work commenced during the summer of 1956 and was to be completed by the end of 1957. Daily throughput capacity was to be increased to 190,000 barrels.

There will be two new atmospheric crude distillation units, and expanded distribution and terminal facilities. Greater production of middle distillates, marine diesel and residual fuel oil will be stressed. The distillation units will be designed by E. B. Badger and Sons, Ltd.

Early in 1956, Sheik Abdulla as-Salim al Subah was reported to have granted permission to Iraq Petroleum Company to survey a proposed pipe line route from the Basra-area fields (Zubair and Rumaila) across northeastern Kuwait to a coastal point between the Mina al Ahmadi and Kuwait town. The apparent problem is one of congested facilities and shallow water at Fao, at the mouth of Euphrates in Iraq, and the need for an expanded outlet for crude from Rumaila field.

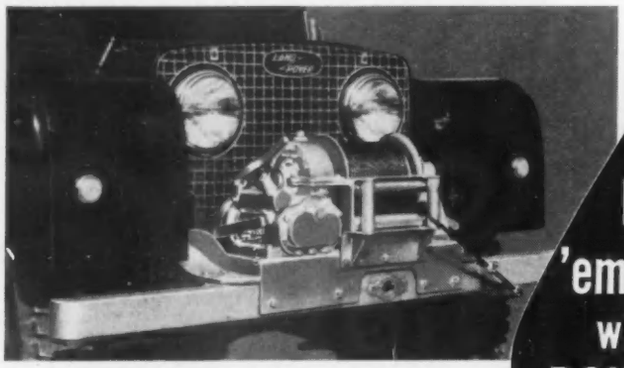
Concessions. The original concession, granted to Gulf Oil Corporation and Anglo-Iranian Oil Company jointly in 1934, covered all of the ruler's territory except his interest in the Saudi Arabia-Kuwait Neutral Zone, and was to be in effect for 75 years. In 1951, the concession was validated to the year 2026, and a profit-sharing plan was negotiated that year, complementing the original which called for royalties on a tonnage basis of crude produced.

Territorial waters within the six mile limit were included in the original agreement between the ruler and Gulf and Anglo-Iranian (now The British Petroleum Company, Ltd.).

But in early 1956, the Sheik announced his willingness to negotiate with British and U. S. companies on Persian Gulf areas offshore from Kuwait. The Sheik was undoubtedly aware of Aramco's Safaniya field, which extends at least 14 miles offshore from Saudi Arabia, just south of his partial jurisdiction in the Neutral Zone.

National Development. The economy of Kuwait, now so rich and with a very limited area over which to spread its money, is enjoying a construction boom, with new homes, public buildings, hospitals, schools, irrigation, and other public works being pushed at a fast pace to enable the tiny country, isolated during such a long period of its history, to catch up with the modern world.

During 1955, a total of 386,398,003 barrels of crude was exported, for a daily average of 1,058,625 barrels. Most of the remaining 12,095,594 barrels, produced during the year but not exported, was refined at Mina al Ahmadi.

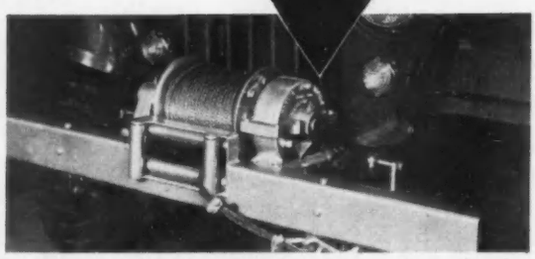


MODEL LR-100 FOR LAND ROVERS. A rugged, dependable reversible winch assembly, this unit combines the popular R-100 King Winch installation with the Model 30 drive assembly to assure long, trouble-free operation . . . rugged service.

Keep 'em moving with the POWERFUL KING WINCH

THERE'S A KING WINCH TO FIT YOUR NEEDS

For any task, any truck, any terrain . . . there's a front-mount King Winch designed to keep you moving. Tough and durable, with pulling capacities up to 19,000 pounds, King Winches are custom-made for practically all makes of trucks . . . are supplied in complete, ready-to-install, ready-to-operate units. Each unit consists of a power winch, shifter levers, power drive mechanism, attaching parts, and all necessary bolts, set screws, keys, etc.



MODEL 151J ON CJ-5 WILLYS JEEP . . . driven by the Model 51 P.T.O. Three speeds forward, one speed reverse through regular transmission . . . controlled from driver's seat.

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- bronze-bushed, 4-way cable guide rollers
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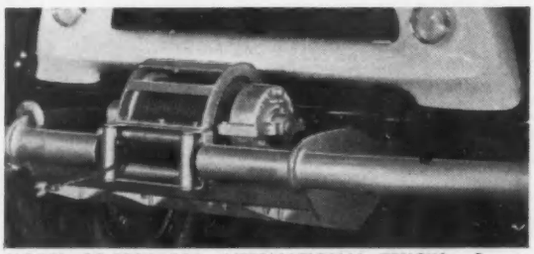

MODEL SG-1204 FOR INTERNATIONAL TRUCKS. Super strength, compactness, quick installation at any service location . . . these are features which make this King Winch so popular with field crews. Low winch mounting provides better drive-shaft clearance, perfect balance.

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For crude, diesel fuel, lubricating and other light oils there are AURORA Centrifugal Pumps by the thousands. APCO Turbine-type Pumps handle the gasolines, naphthas and other volatile, nonlubricating fluids. For tars, waxes, bunker fuel and asphalt KINNEY Rotating Plunger and Heliquad Gear Pumps move the seemingly "unpumpables" along the road to the consumer. But, the services rendered to Petroleum (as well as other industries) by The New York Air Brake Company go well beyond the sphere of Liquid Handling equipment.

The Kalamazoo Division, for example, produces the DUDCO and HYDRECO Fluid Power components, so well known throughout industry, for rotary tables, cat heads and the numerous functions of portable drill rigs. DUDCO Fluid Motors serve to open and close remote pipe line valves.

In the areas of distillation and petrochemical production, the KINNEY MFG. Division makes a significant contribution with KINNEY High Vacuum equipment. Last, but not least, The New York Air Brake Company furnishes the added factor of safety to tank cars that transport petroleum products—the Air Brake equipment for which the company is named.

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Neutral Zone . . . Exploration takes downturn as drilling and production rise.

SAVE FOR a downturn in exploration efforts, the Neutral Zone's petroleum activities reflected rising trends in comparison with the 1954 program:

- Crude production climbed 47.7 percent.
- Development drilling rose 30 percent in number of completions.
- The total amount of footage drilled in the field development program increased 21.1 percent.
- Exploration drilling dropped 50 percent in number of well completions.
- Total footage drilled in these wildcat tests slipped 31.1 percent.

With crude production of 8,847,769 barrels last year, equivalent to a daily average yield of 24,240 barrels, Wafra field recorded its significant upturn from the previous year. In 1954, total output of 5,991,000 barrels amounted to a daily average rate of only 16,414 barrels, or 7826 barrels per day less than during 1955.

Proved crude reserves as of Dec. 31, 1955, were estimated at 390 million barrels. No proved natural gas reserves were reported.

During 1955, drilling was continued with two rigs, resulting in the completion of 13 producing wells in the Wafra field and two exploratory tests which were non-producers.

Producing Wells. At year's end, 29 producing wells were reported, with two more wells drilling at Dec. 31, 1955.

One of the 1955 exploratory tests, Humma 1, located in the southwest corner of the Kuwait-Saudi Arabia Natural Zone was drilled primarily to test the Jurassic formations. The second test, Shadhof 1, southeast of Wafra field, tested the Burgan sand. No wells were drilled to the lower or Ratawi horizon discovered in 1954.

Total depth of Shadhof 1 was 4091 feet, and Humma 1 was drilled to 8513 feet.

In Wafra field, 46,150 feet of hole was drilled, with 12,604 feet of exploratory hole being drilled. The average depth of development wells drilled last year declined 260 feet—from 3810 feet to 3550 feet. The average depth of the two wildcat tests was 6302 feet, whereas the average for four wildcat wells completed drilled in the previous year amounted to 4573 feet.

During 1956, the Ratawi zone is expected to be put on production. Exploratory drilling is scheduled to be carried out to test possibilities in certain shallow Eocene horizons.

No geological or geophysical exploration is expected to be done during 1956.

American Independent Oil Company, sole operator in the Neutral Zone, is owned by a group of ten U.S. independent producers, and, on behalf of itself and Pacific Western Oil Corporation, holds a concession to the sheikhdom of Kuwait's undivided half interest in the 2600-square mile desert region. Pacific Western holds the concession from Saudi Arabia to its half of the zone.

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Featuring light-weight swivels, the King line also includes circulating heads and wire-line strippers.
King KM Swivels are designed for drilling with chain or cable pull-down means and are intended as replacements on popular makes of pull-down type rigs. There are three sizes in the KM series.

XV SERIES SWIVELS are produced in six sizes for capacities of 15,000 to 87,000 lbs. at 100 rpm.

ALLOY STEELS assure strength with minimum weight.

OVERSIZE WATER-COURSES permit circulation of more drilling fluids.

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Qatar . . . Production rises 13.8 percent.

PRODUCTION IN Qatar in 1955 rose to 41,807,830 barrels, for an average of 114,542 barrels daily. This represents an increase of 13,906 barrels over the 1954 daily average of 100,636 barrels, or 13.8 percent.

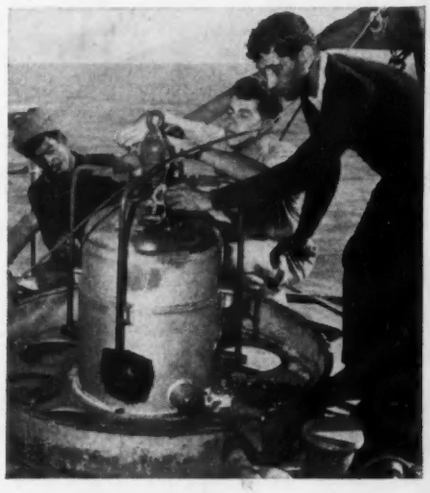
Qatar production thus has shown big increases in each of the last three years. The yield in 1953 was 23 percent greater than that in 1952; in 1954, there was an 18 percent rise above the 1953 mark. Dukhan field, the sole producing locality on the peninsula of Qatar, appears to be reaching development maturity, as the rate of increase of production, though still sharp, has been a little less percentagewise each year.

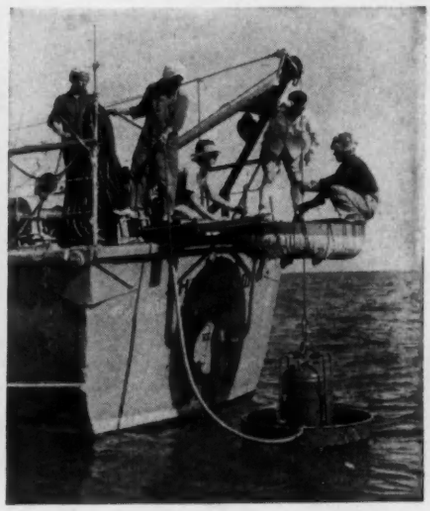
Nine wells were completed during 1955, six of them being completed as producers. Another well was being drilled at the end of the year. Total footage drilled was 54,720 feet, 24,703 feet of hole more than was drilled in 1954, when 30,017 feet was reported. Four wells were drilled in 1954. Average depth of wells drilled in 1955 was 6080 feet, as compared with 7504 feet in 1954.

Total cumulative production from Dukhan field at the end of 1955 was about 166,607,000 barrels.

Qatar Petroleum Company, Ltd., an affiliate of Iraq Petroleum Company, Ltd., holds the concession covering the entire peninsular Sheikdom. Dukhan field lies on the west side of the peninsula. Crude is transported through 14½- and 20-inch lines across to the east coast port of Umm Said, 60 miles away, where it is loaded into tankers. There is a small topping plant at Umn Said, with a capacity of 600 barrels daily which fulfills local product needs.

The Royal Dutch Shell group, represented by Shell Company of Qatar, Ltd., has concession rights offshore from Qatar, dating from a late 1952 agreement. An offshore rig capable of 7000 feet, operating from a 1900-ton mobile steel platform, was assembled at Doha, the capital of Qatar, 20 miles north of Umm Said on the west coast, and was barged to a location three miles offshore. The first test was a failure, and a second location, over 40 miles offshore, was being drilled in 1956.





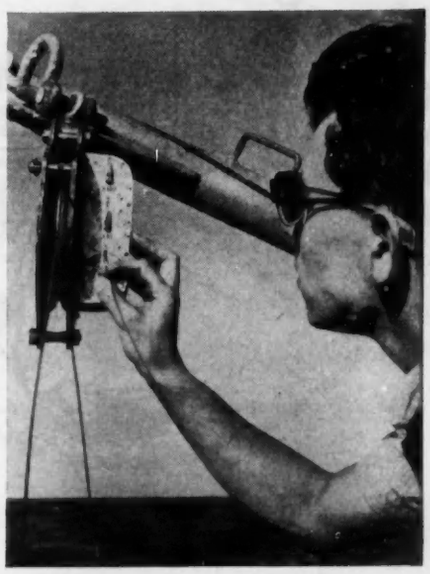
Exploration in Persian Gulf

Above left: Shell Company of Qatar, Ltd., gravimetric exploration crew, aboard a company launch, inspects the waterproof steel housing containing a remote control gravity meter. The instrument takes measurements of the slight variations in the force of gravity on the sea bed caused by underlying rock formations.

Above right: The remote control gravity meter is lowered over the stern of the launch.

Right: Crew member checks underwater depth of the remote control gravity meter by means of a meter wheel aboard the launch. The Shell Company currently is using the gravimetric method in conjunction with the seismic method to search for oil in the Persian Gulf.

Photos courtesy of Shell Petroleum Company Ltd.



In the seismic survey, two launches are used, a shooting boat which fires charges and an instrument boat which tows seismometers on floats to pick up vibration waves as they reflect from rock layers beneath the sea bed. Above, crew members check seismic floats on deck of the instrument boat.

Captain of the instrument boat follows course with a new navigational aid. The instrument covers the whole exploration area with a lattice of short waves sent out from three stations set up on land. The instrument is used so that the exact position of the survey launches can be known when readings are taken or charges fired.

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Exploration costs can be excessive — or they can be reasonable. Experience and sound judgement permit cost cuts in the right places. Companies who invest their exploration dollar with Petty are assured of getting the lowest cost per survey mile consistent with highly accurate interpretations. This result is a matter of pride with Petty's loyal crews. More than 42% of the key men have been with Petty for over half the company's 31 years. Petty is the oldest exploration geophysical company in continuous operation. Wherever you search for oil — in the jungles or in the desert — on shore or off — Petty can give you the most for your exploration dollar. Why settle for less?

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SEISMIC GRAVITY MAGNETIC SURVEYS

Dharan, Aramco's biggest single residential community, is site of company headquarters. A large proportion of the 2989 American and other senior staff personnel employed by the company in Saudi Arabia live in the city.

Saudi Arabia . . . Crude production and industry development continue to rise steadily. World's largest offshore field to go on production this year.

STEADILY INCREASING crude production and development of all phases of the oil industry continued during 1955 and 1956 pursuant to Arabian American Oil Company's long-range program of orderly expansion in Saudi Arabia. No new fields were discovered in 1955, but in June, 1956, Aramco announced the finding of an important new crude reserve at Kharsaniya, Well 1, 80 miles northwest of Dhahran near the Persian Gulf shore.

Production. Crude oil production during 1955 was 352,239,912 barrels, or an average of 965,041 barrels a day. There were 154 wells on production, the average production for the year being 2644 barrels daily per well. Crude production in 1954 was 347,844,850 barrels, or 953,000 barrels daily.

Thus, 1955 production rose by 12,041 barrels, daily, or 12.6 percent above the previous year. This increase was in spite of the return, in large measure, of Iranian oil to the world's markets. Production during the latter part of the year exceeded 1 million barrels daily. The daily average for October was 1,002,442 barrels; for November, 1,041,098 barrels; and for December, 1,028,216 barrels.

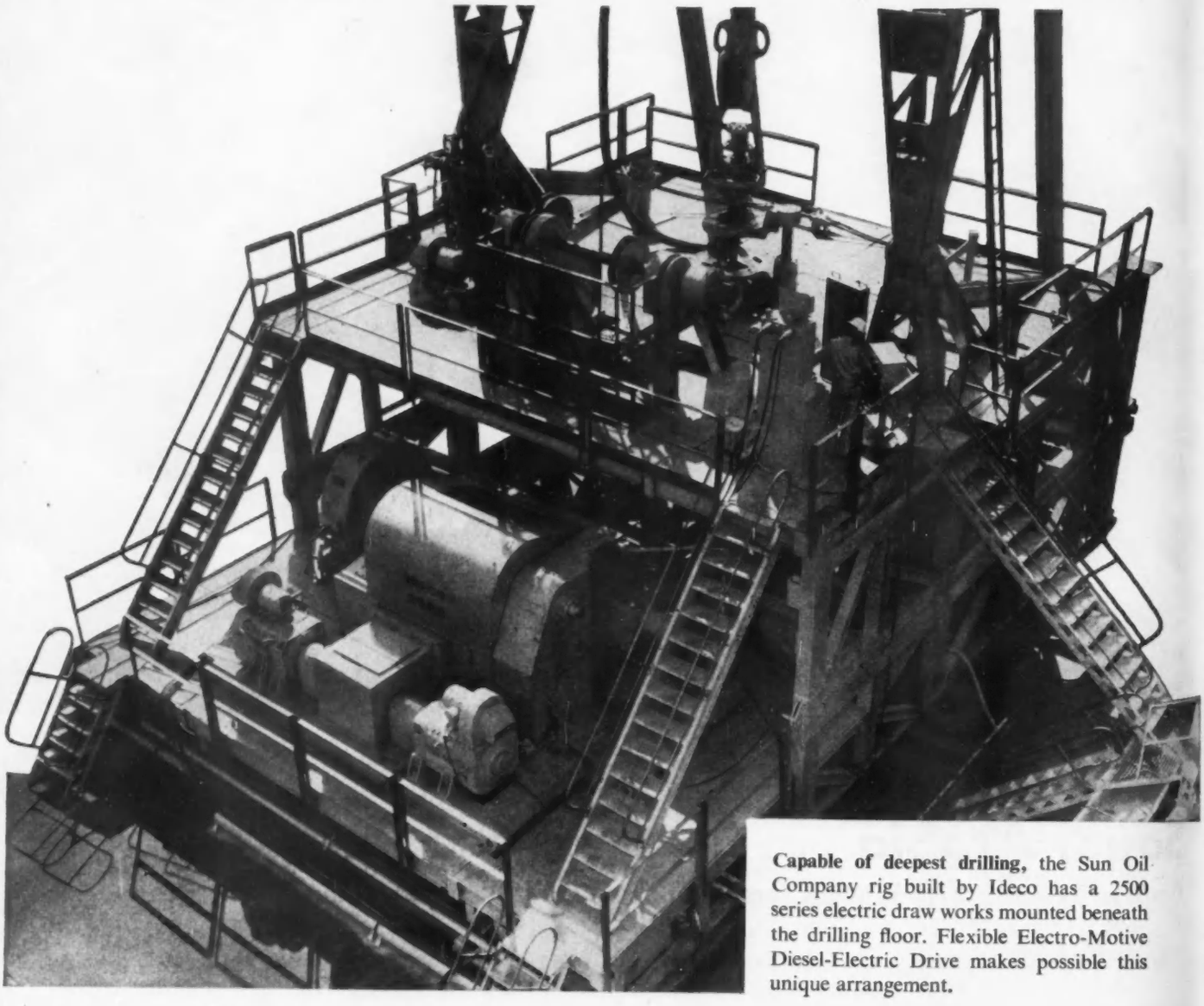
And crude production in Saudi Arabia continued to climb in 1956. The daily average production for March was 1,008,957 barrels, and in May 1,121,298 barrels. It appeared that average daily production for 1956 would exceed 1 million barrels. Average production for the first five months in 1956 was 158,067,199 barrels, an average of 1,039,916 barrels daily, or 7.76 percent above the 1955 average.

Four fields were on production during 1955; Qatif, Dammam, Abqaiq, and Ghawar. The latter consists of several separately-considered parts—Ain Dar, Shedgum, Uthmaniyah, Al-Hawiyah, and Haradh.

There appeared no longer to be any question that Ghawar Field, however, is 140 miles long and up to 18 miles wide, and includes all of these extension areas. Ghawar field is the biggest oil field in the world area-wise, and probably reserve-wise as well.

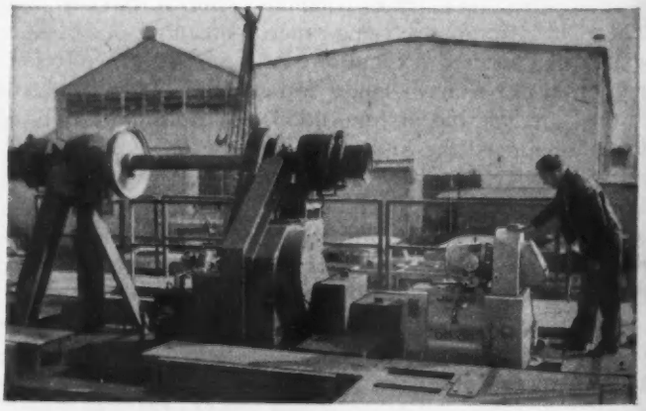
Plans were underway during 1956 to put Safaniya field, in northern Saudi Arabia, on production, too. Safaniya is the world's largest marine offshore field, having a proven area of 125,000 acres. It was doubtful that the field's total extent had yet been

It's the cleanest, most



Capable of deepest drilling, the Sun Oil Company rig built by Ideco has a 2500 series electric draw works mounted beneath the drilling floor. Flexible Electro-Motive Diesel-Electric Drive makes possible this unique arrangement.

B. H. Hefner, Chief Electrical Engineer of Electro-Motive Division (center), discusses application of GM Diesel-Electric Drive with "Buck" Wilder of Sun Oil Company (left) and W. O. Cook, Vice-President of Ideco.



Newell B. Collins, Electro-Motive Service Engineer, inspects arrangement of drilling platform, where only one motor is mounted to drive rotary table and cathead.

flexible rig in sight

Sun Oil Company's new Ideco rig with Electro-Motive Diesel-Electric Drive takes the draw works off the drilling floor

Innovation in deep-well drilling rigs is the new unit built for Sun Oil Company by Ideco, one of the Dresser Industries, at its plant in Beaumont, Texas.

Powered by a pair of Electro-Motive SR-8 Diesel-Electric generator sets driving 7 motors, this revolutionary rig offers entirely new standards of flexibility, efficiency and economy.

Only one motor, powering the rotary table and cathead, is mounted on the platform. The Ideco 2500 series electric draw works is located beneath. This design avoids clutter, saves space and makes the rig easier and more economical to move.

Electro-Motive Drilling Rig Power Plants can be used with *any* drilling equipment operating today. The motors driving draw works, rotary table and mud pumps are connected by flexible cable to the generating units—and the connections can be made by anyone with a simple understanding of house lighting.

But to make doubly sure the equipment is properly used, we instruct your people both on the job and at our Factory Training Center in La Grange.

For further information about this moneysaving Diesel-Electric power, call your nearest Electro-Motive Representative.

Features of Electro-Motive Drilling Rig Power

Completely Integrated Design—Each of the major components designed and built to work together—*one* manufacturer—*one* source of service responsibility.

Maximum Portability—All components on skids with weight reduced to a minimum. Units are ruggedly built to withstand handling. No position problem—slashes setup and moving time on land rigs.

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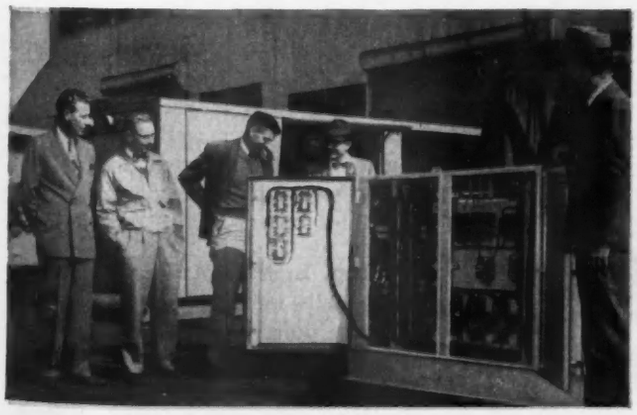
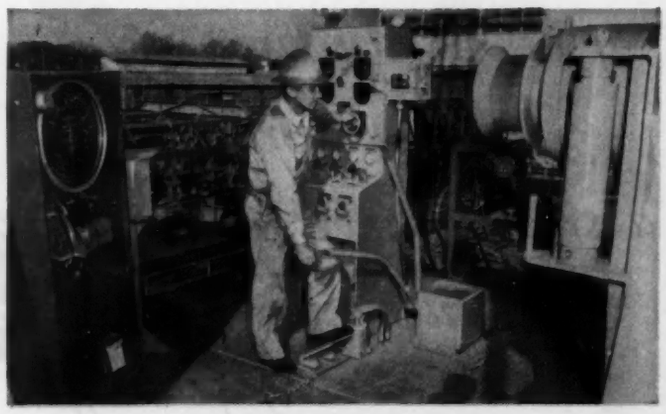


Compact electrical control cabinet utilizes proved components of General Motors Diesel-Electric locomotives. In photo are W. O. Cook, Bert Hefner, Bill Withers, Sun Oil Company, "Buck" Wilder, Sun Oil Company, and A. R. McLerran, Ideco.



Driller's control stand is located on corner of the floor. Control panel carries selector switch, engine speed, mud pump, hoist and rotary table controls, as well as warning lights and safety switches.

determined. Discovery occurred in August, 1951, when Safaniya Well 1 was completed. As of the end of 1955, there were two oil producers onshore, 15 offshore, and one observation well. All wells were shut in. The field extends at least 14 miles offshore.

Early in 1956, International Bechtel Inc. of San Francisco, Calif., pipe line contractors, broke ground for a $12 million, 137-mile, 22-inch line along the Persian Gulf coast to connect Safaniya field with the Ras Tanura refinery. A network of 6 and 8-inch submarine pipe lines was projected, leading to a gas-oil separator plant just onshore from the field. Safaniya crude —26.8 gravity—is heavier than average Saudi Arabian crudes. It has a high fuel oil yield when topped. The greatly increased demand for fuel oil in Europe was the main reason Safaniya was being put on production. Projected completion date for the new pipe line is April 1, 1957, and planned initial capacity is to be 50,000 to 75,000 barrels daily, to be increased later to 125,000 barrels per day.

The two other oil fields in Saudi Arabia, Abu Hadriyah and Fadhili, have been developed little. At the year's end, one well was shut in at Abu Hadriyah, one was suspended, one was abandoned, and a fourth well was being drilled. At Fadhili, one well was shut in. The new field on the extensive Kharsaniya structure, however, may be a major find, though it was too early for thorough evaluation. On a drillstem test of the top of the Arab zone of the Jurassic from 5954 to 5976 feet, the well flowed at the rate of 2200 barrels daily of 32-33 gravity sour crude, with surface pressure reading 800 pounds and gas-oil ratio, 340. In early July, the well was coring, still in the Arab zone, at 6168 feet.

Cumulative crude oil production in Saudi Arabia passed the 2 billion barrel mark on Feb. 20, and reached 2,306,808,988 barrels at the end of 1955.

Gas production was growing increasingly important in Saudi Arabia. In 1955, a total of 43,983,860 cubic feet was produced, saved, and sold. Also, at Abqaiq, 43,564,697 Mcf was compressed at the gas-injection plant and used to repressure the oil reservoir. Most of the gas produced at Abqaiq is needed for injection and other industrial uses, and it is being returned to the formation at the rate of 150 Mmcf daily.

Gas produced at Dammam and Qatif is being used in Dharan, where industrial and household needs soon may outstrip available supply. Full utilization of gas from Ghawar field for pressure maintenance, LPG, industrial uses, and export, is being studied.

A second gas-oil separator plant at 'Uthmaniyah went on stream July 23, 1955, to which seven wells are connected that produce from the Arab-D zone.

In 1956, a water injection program to supplement the gas-injection project went into operation in the north end of Abqaiq. The reservoir is not producing water, which is being drawn from three water wells in the area, but the pressure maintenance program is felt essential to provide maximum ultimate recovery.

Drilling. In 1955, Aramco completed seven wells, including three producers, one dry hole, two water-injection wells, and a supply well for water injection. Five rigs were active, four drilling and one assigned to workover duties.

During 1956, four drilling rigs were active through mid-year. Drilling will

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- NO TURBULENCE
- MINIMUM PRESSURE DROP
- DOUBLE ROW THRUST BEARINGS
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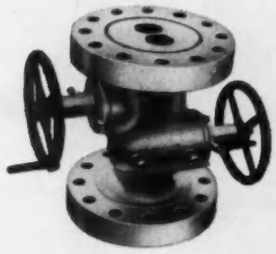
The heavy stem loads, set up by high pressure, are balanced out in this valve so that it opens or closes with one hand under full rated pressure. Sizes: 2" and 3½". Working pressures: 10,000 and 15,000 lb. WOG.

FOR DUAL COMPLETIONS

DUAL VALVE



Two valves in one body. Dual completion efficiency is greatly increased and assembly simplified. These valves are available in 2" and 2½" sizes for running two tubing strings in 7" or 8⅝" casing.

RECESSED BODY VALVE

The recessed body permits two parallel strings of tubing to be run in 7" or 8⅝" casing for dual completions when dual valve is not used. Sizes: 2" and 2½". Working pressures: 2000 to 5000 lb. WOG.

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be stepped up slightly, with plans for a new rig to be brought in during the fall, and another tentatively scheduled for early 1957. Aramco had programmed this drilling expansion even before the wildcat at Kharsaniya came in. Now, some increase in drilling is more essential than before.

Two wells were completed in Safaniya and one in Ghawar. All were completed in previously-established pay zones, extending the fields and increasing known reserves. One test was taken to 13,297 feet at Safaniya, more than 7000 feet below the field's Cretaceous producing zones (Bahrain and Zubair).

Official Aramco estimates of crude oil reserves at the end of 1955 give a minimum figure of 35 billion barrels. Drilling at Kharsaniya may raise that figure considerably by the end of 1957.

Saudi Arabia's deepest well to date, Stratigraphic Well 1, was abandoned early in 1955 at 14,875 feet. This test was one of the rankest wildcats ever drilled. Location was 230 miles due south of the Dukhan field (Qatar) and 190 miles southeast of the nearest production at Haradh, in the southeastern interior of the Rub al Khali ("Empty Quarter," or southern Arabian desert, one of the biggest surface sand masses in the world).

Aramco had not released details of the test's findings, but no indication that the well was near basement was found. One geologist's opinion was that the well was in Permian at total depth. In this regard, the fact that a deep test drilled in 1955 on Bahrain Island encountered gas shows in the Permian is noteworthy. It recalls the fact that the first producing well in Saudi Arabia, Dammam 71, was drilled in 1938 to the Jurassic largely on the basis of a deep Bahrain test that produced gas from that horizon, after a number of Saudi Arabian wells failed to find commercial oil in the Cretaceous beds producing oil at Bahrain.

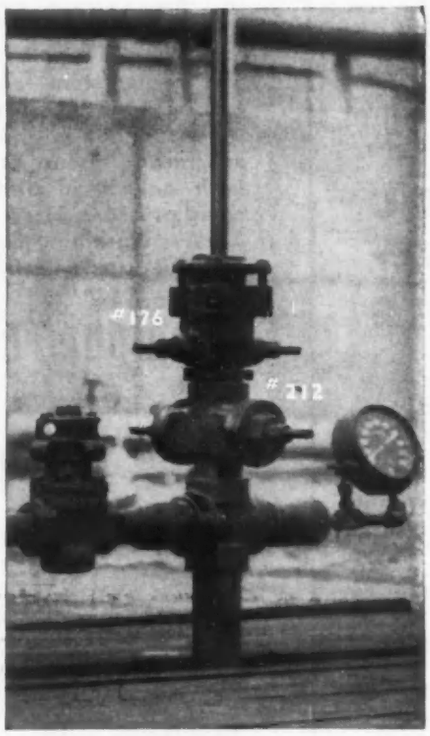
After Stratigraphic Test 1 was plugged, the rig was moved 260 miles northwest to the 'Uthmaniyah area.

Pipe Lines and Plants. A 7-mile crude pipe line from Abqaiq gas-oil separator Plant 2 was added to the field's gathering system. At Ras Tanura terminal, a third crude oil loading line was added, among other facilities installed to expedite loading of tankers. Two new product tanks installed in October increased storage capacity of the terminal by 360,000 barrels.

Crude delivered to Sidon, Lebanon, in 1955 via Tapline totaled 117,988,503 barrels, or an average of 323,256 barrels daily, a 3.66 percent increase from 1954. During the first five months of 1956, Tapline delivered 49,468,133 barrels, or 325,448 barrels daily.

Early in 1956, the Safaniya-Ras Tanura crude pipe line was under way, and in May, Trans-Arabian Pipe Line Company announced a 90,000 barrels daily capacity increase to be installed in Tapline. The project was scheduled to be completed by Jan. 1, 1958, increasing the current capacity from 320,000 barrels daily to 410,000 barrels.

The new facilities, to be located in Saudi Arabia, Jordan, and Lebanon, will cost $14 million and will start arriving in February, 1957. Unattended radio-controlled portable auxiliary pumping units will be installed



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The No. 176 is designed so the polished rod is self-aligning, operating at maximum efficiency at all times. It is the only unit of its kind on the market that receives lubrication direct from the pumping well. Also the No. 176 can be "shut off" while repacking the box.

The No. 212 is comparatively light in weight, yet has 3000 pounds capacity. It is equipped with Ratigan's new type, quick changing retractable rubbers. In addition to its use as a blowout preventer, it also can be used for swabbing or running rods in wells that head or flow, in the course of operations.

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midway between existing pump stations at Qaisumah, Rafha, Badanah, and Turaif in Saudi Arabia. The most westerly unit will be located at Qaryatain in Jordan, and a fifth unit will be added to facilties at Turaif.

Each auxiliary pumping unit will consist of four portable vans, with foundations, manifolds, and a radio tower. The pumps will be remotely controlled from the main stations by radio. One van will contain a 5000 horsepower two-shaft combustion gas turbine, fueled by crude oil; another will house air filters and controls; the third, standby power plant and radio equipment; and the fourth will carry tools, parts and emergency quarters for transient personnel.

The heaviest van, containing the turbine, will weigh 110 tons. A single stage centrifugal pump separated from the turbine by a fire wall, will be driven by the turbine at speeds ranging from 4500 to 5500 rpm.

The project also calls for construction of additional storage facilities at Rafha, Badanah, Turaif, and at the Sidon terminal, and other improvements.

A total of 74,171,745 barrels of crude was refined at Ras Tanura in 1955, or an average of 203,210 barrels per day. This was a drop of 5,672,851 barrels, or 15,542 barrels daily, from 1954. Despite the increase in demand for Arabian crude, 1955 demand for refined products from

TABLE 1—Status of Wells in Saudi Arabia at End of 1955

FIELD	Wells Producing	Shut in or Standing	Observation	Suspended	Abandoned	Drilling	Total
Abqaiq	50	14*	4	0	1	1	70
Abu Hadriyah	0	1	0	1	1	1	4
Dammam	25**	5	1	0	10***	0	41
al-'Alah	0	0	0	0	1	0	1
al-Jauf	0	0	0	0	1	0	1
Fadhili	0	1	0	0	0	0	1
Ghawar:							
'Ain Dar	44	5	2	0	1	0	52
Shedgum	11	0	1	0	1	0	13
'Uthmaniyah	18	17	3	1	1	2	42
al-Hawiyah	0	1	1	0	0	0	2
Haradh	0	7	1	1	0	0	9
Total Ghawar	73	30	8	2	3	2	118
Ma'qaia	0	0	0	0	1	0	1
Qatif	9	1	1	1	1	0	13
Safaniya	0	17	1	0	0	0	18
Stratigraphic Well	0	0	0	0	1	0	1
Total	157	69	15	4	20	4	269

* Including two gas-injection wells. ** Including three gas wells. *** Including two gas wells.

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The **conventional** blasting cap used in Jet Perforating Guns has always been a source of danger to life, wells and other property . . . because it requires only about 1/10 of a watt of electrical energy to detonate the cap and thereby accidentally fire the whole gun. This inherent weakness of the **conventional** blasting cap was determined years ago by PGAC engineers when they discovered that such infinitely small amounts of electrical energy could be picked up by the firing circuit from stray currents or from discharges of static electricity around or within the well.

RESEARCH REWARDED

PGAC engineers finally devised a completely new blasting cap assembly, combining a high-resistance element and a fuse in the circuit. PGAC's new cap cannot be detonated until after its fuse is burned away — and the fuse cannot be burned away by other than a **relatively high current.** Such current cannot be picked up accidently by the circuit — but must be introduced **by the simultaneous closing of two electrical circuits** which, in turn, can be accomplished only by two hands simultaneously and intentionally operating two separate switches on the control panel.

INVENTION PATENTED

All features of this new blasting cap assembly and its unique firing circuit have been fully protected by United States Patent No. 2,703,053 granted to the Perforating Guns Atlas Corporation. The new blasting cap assemblies and firing circuits have been exhaustively field-tested for several years and found as foolproof as humanly possible.

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In the interest of **Increased Safety** for the entire Jet Process Perforating Industry, PGAC has made available to **all** present and future licensees having the right to use the Jet Process, the additional right to use this new PGAC invention **without the payment of royalty of any kind.**

USE INVITED

It is sincerely hoped by PGAC that their confreres of the Jet Perforating Industry will avail themselves of this contribution to **the Greater Safety of their personnel and their customers' property.** No other reward could be so gratifying to the men and women of PGAC.

PGAC 566

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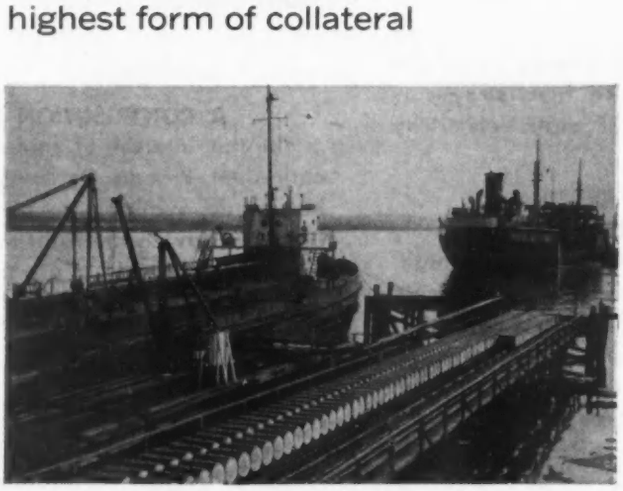

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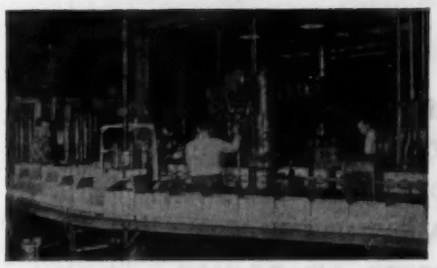

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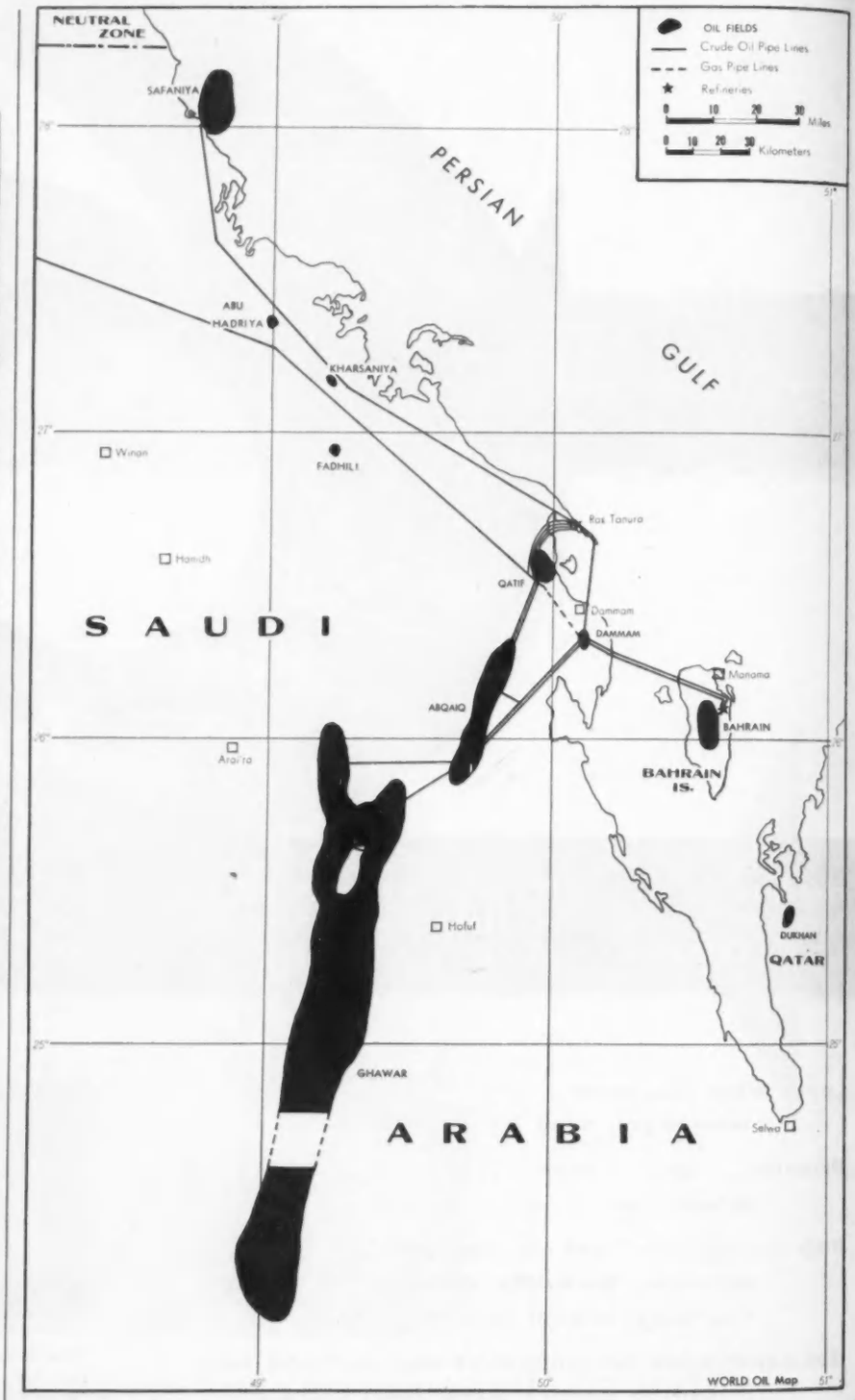


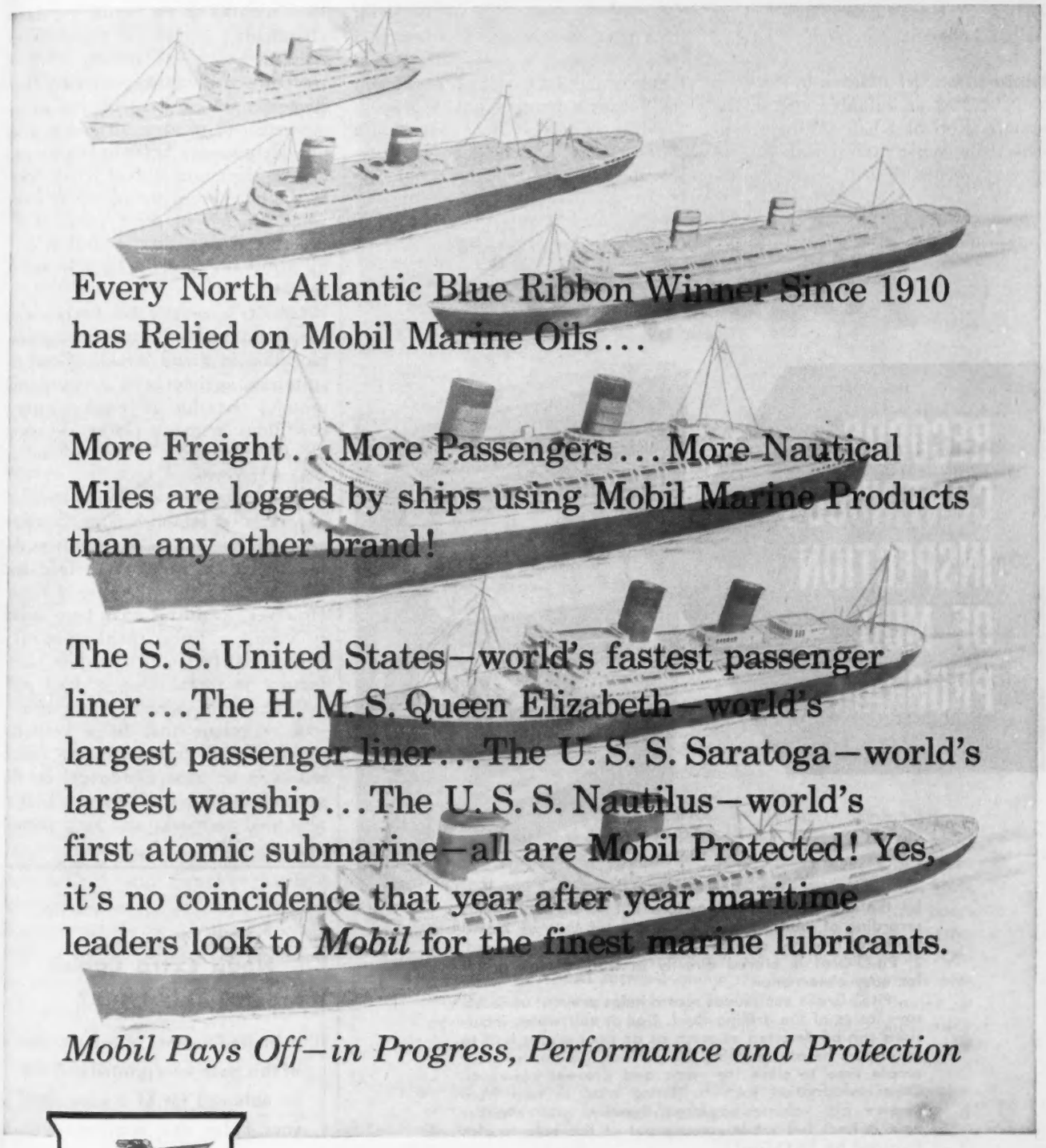
SAUDI ARABIA . . . Since the offshore oil field at Safaniya was discovered in 1951, 15 producers have been drilled offshore, 2 onshore, in addition to one observation well. The field extends at least 14 miles offshore.

Ras Tanura decreased slightly. During the first five months of 1956, 33,192,845 barrels of crude was run to Ras Tanura stills, or 218,374 barrels per day, 6.88 percent above the same period in 1955.

Twenty-one percent of the crude produced in Saudi Arabia in 1955 was refined there.

The first fluid hydroformer to be built in the Middle East went on stream at Ras Tanura in October, 1955. This $13 million catalytic reforming unit is designed to produce 8700 barrels of 92 octane gasoline daily, for blending with other stocks.

It's no Coincidence...



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In addition, a plant completed during the year produces nitrogen for the hydroformer and oxygen for welding.

Engineering work is under way on a 15,000-barrels-a-day $4.1 million desulfurization unit.

During 1954, 1758 tankers were loaded at Ras Tanura and 843 at Sidon, Lebanon.

Exploration. In addition to the deep wells drilled at Safaniya and in the eastern Rub al Khali, Aramco continued its exploration with surface geology, structure drill, seismic, gravity, and magnetometer. Three structure drill, three seismic, one surface mapping, and one combination gravity-magnetic parties were working in Saudi Arabia at year's end.

Geological and geophysical exploration in the Rub al Khali progressed satisfactorily despite the many hardships that the terrain, weather, and sand conditions impose. The Rub al Khali is about the size of Texas, but the former's borders are ill-defined. Outcrops are very few, what with shifting sand and lake deposits covering most of the surface, rendering field geology of slight use.

Sand dunes range from 30 to 100 feet in height, and shift constantly. The parties do not work during the three mid-summer months because of the intense heat. Nevertheless, a seismic party, running long lines parallel to the transverse dunes (barchans), completed rapid reconnaissance surveys during 1955. A structure drill group, working from two separate camps, with one rotary rig attached to each, drilled a series of widely spaced holes in the western and southwestern Rub al Khali. Some of the holes were completed as water wells, though in some parts of the desert it is necessary to drill as deep as 3000 feet before any water is found.

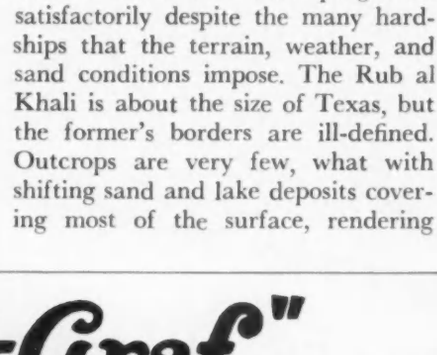
Gravity generally has been a very successful mode of reconnaissance exploration in Saudi Arabia. Good results have at times been achieved with seismic, but due to erratic surface conditions in many places, occasionally it is impossible to get satisfactory seismic records.

Aramco surface geologists and surveyors have established an accurate triangulation net as far south as the southern edge of Ghawar field and some distance into the Rub al Khali. However, astrofixes have been found to afford a horizontal accuracy within 100 feet which is quite satisfactory in establishing ground control for reconnaissance exploration.

A technique that helps keep the shifting sand from covering bench marks is to pour crude oil on the ground around it. This method is also used to mark, and keep packed

"Pit-O-Graf"

RECORDS CONTINUOUS INSPECTION OF MUD PROGRAM



Continuous evaluation of the planned mud program by the driller is made possible by: 1., Instantaneous recording of mud pit level variations (as little as 2 or 3 tenths of one per cent in the entire mud system); and, 2, Pit-O-Graf is placed directly in front of the driller for easy observation.

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down, truck routes in remote desert areas.

Work in the Rub al Khali has established the existence of a separate Tertiary basin there. It is possible that the Jurassic trend, so prolific through the Ghawar field and extending farther north, does not continue very far south of Ghawar.

The Saudi Arab government began an aerial photographic survey early in 1956, scheduled to cover 200,000 square miles of the shield area of western Saudi Arabia. The survey was being done by Aero Service Corporation, of Philadelphia, based at Jiddah, on the Red Sea coast. The maps are to be used for geologic, agricultural, ground water, and transport studies. This area appears to have no oil prospects but the survey should aid in the geologic evaluation of the country.

Aramco completed an aerial photographic survey of the southern Rub al Khali in 1955, and one surface geological party worked in the southwestern Rub al Khali during the year.

In the rocky country of the northwest concession area, two structure drill parties were at work. One well was drilled to 5000 feet for stratigraphic information. In the Gravel Plains area, a seismic party worked during the first half of the year, and two structure drill parties worked the same area during the last half of 1955. One seismic party spent a month engaged in marine work in the Persian Gulf, and another worked land areas between proven oil fields. A seismic survey of northern Abqaiq field was conducted to guide plans for the water-injection program.

Considerable work was done by geologists in various parts of the country on ground water problems.

Concession. In July, 1955, Aramco made its third territorial relinquishment to the government, dropping one area in the northwest and another in the southeast, aggregating 33,000 square miles.

Construction. Excavation work commenced for a new three-story admin-

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According to log sheets kept by the Timken Company's locomotive shop foreman, this equipment has operated 24,242 hours since it was put in service. Moreover, these hours have been logged under adverse conditions of extreme dust and heat, 24 hours a day, seven days a week for an average of 621 hours a month. Because of this record of performance this locomotive has been nicknamed "Old Reliable" by the men in yard. "Old Reliable" has been serviced under the Timken Company's preventive maintenance program. The TCD's were overhauled at approximately 14,000 hours and will have almost that many hours before the next overhaul.

Other applications of Hercules TCD's such as busses, generator sets, mine cars, marine applications, etc., have established similar record of power and performance. Yes, Turbo-charging is not new at Hercules. TCD is just a new name for a tried and proven product.

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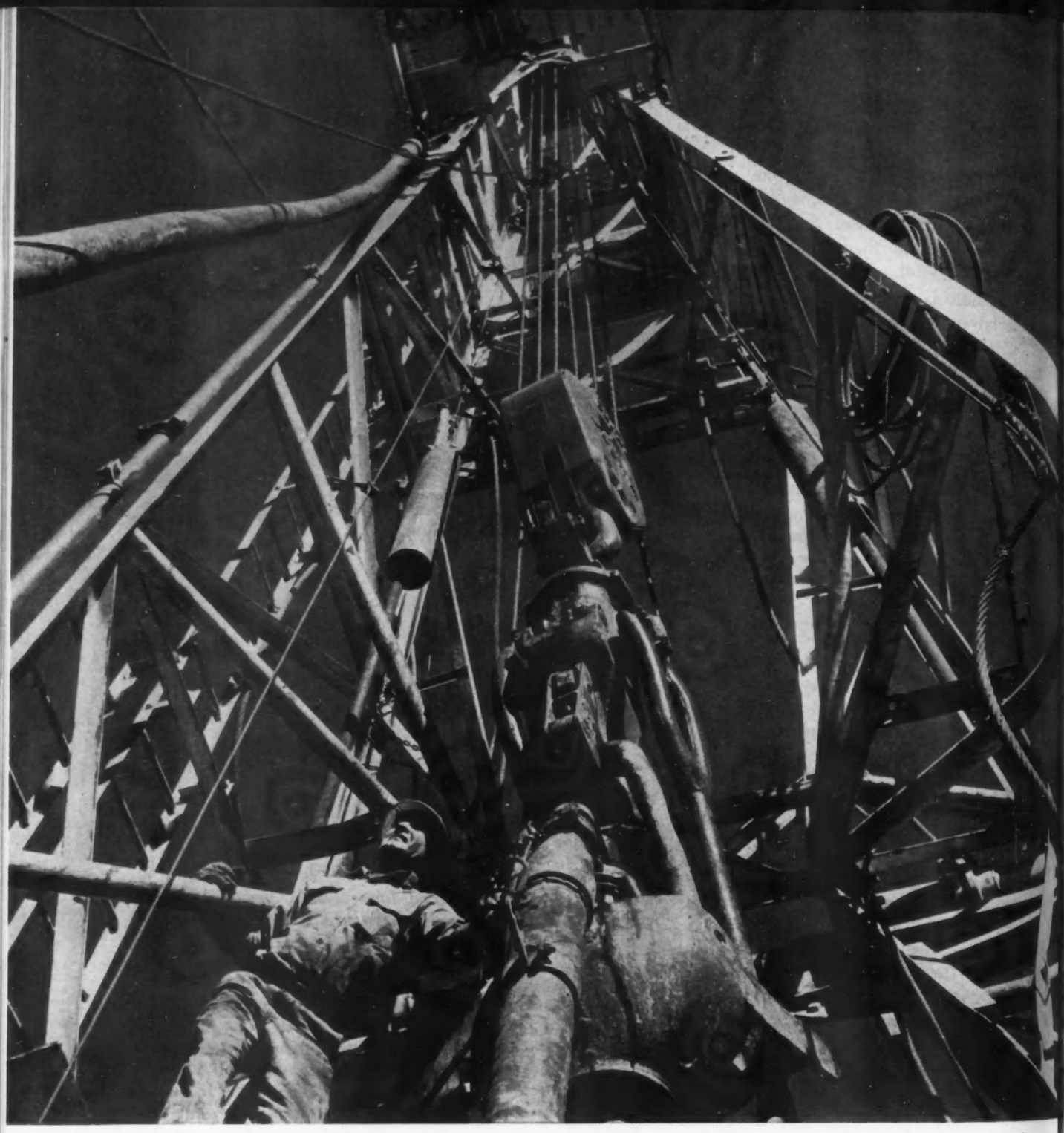

Wire Rope at Work—Out on the plains of Kansas, the Shields Drilling Co. was making hole fast when this photograph was taken. Drilling had progressed to approximately 3000 ft, with an ultimate depth of 4200 ft in prospect. The rig in the picture was a veteran, one that had logged a lot of hole; it had drilled some 300,000 ft in a period of four years.

On this particular job, the rotary line was Bethlehem 1-in. 6x21 Seale, Purple Strand grade. It was the latest of several Bethlehem ropes, all of them excellent performers. Careful, detailed records showed an average of 16 wells per Bethlehem rope; or in terms of ft, 50,000 to 60,000 ft of hole drilled per rope. This is the sort of consistency that users like, and it is always particularly pleasing when costs are figured.

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istration building in Dhahran to be completed in 1957. The new office building will augment the present one, and will replace most of the portable office buildings, which will be moved elsewhere. The new building will cost about $5.3 million. Also, a new $705,000 communications building, to house Aramco's telephone and central radio-telephone system, is being built at Dhahran.

Employe Relations. At the end of 1955, Aramco had 21,073 employes, 20,397 of whom were in Saudi Arabia. Of these, 13,371, or 65.6 percent, were Saudis; 2989, U. S. citizens; 1391, Pakistanis; 1105 East Indians; and 1541 individuals of Palestinian, Italian, Adenese, Sudanese, Dutch, and other nationalities.

Aramco's safety program paid off with a reduction of disabling injuries for the fourth straight year. The rate of occurrence of such injuries dropped from 7.9 per million hours worked in 1954 to 7.2 in 1955.

Aramco's experimental program to provide summer work for Middle Eastern college undergraduates has shown encouraging results, and the program will be continued and expanded.

Job-rated classes for Saudi employes of Aramco in Dhahran and Abqaiq occupied new buildings in July 1955. Each building has 20 general classrooms, a drafting room, science laboratory, business-machines classrooms, visual aids workshop, projection room, and a library. The larger Dhahran building has four additional classrooms. About 1400 Saudis received instruction daily in arithmetic, languages, layout, drafting, office practices, mathematics, and applied science. About 2000 other students attended similar classes available on a voluntary basis to all Saudi employes on their own time. Construction of a two-story Aramco school at Ras Tanura was under way in 1956.

Six schools, with admission preference given to sons of Aramco employes but controlled by the Saudi Arab government, operated in Dammam, al-Khobar, Hofuf, al Mubarraz, Rahimah, and Saihat. Three more, at Dammam, al-Thaqbah, and Safwah, were under construction and slated for 1956 construction.

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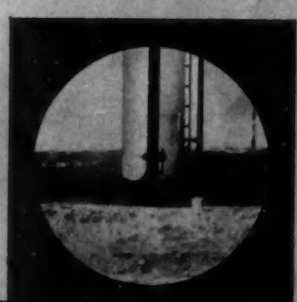

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NONCORROSIVE

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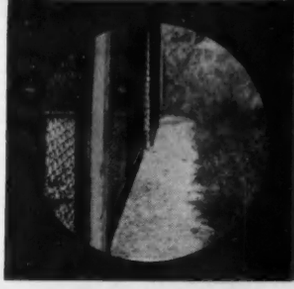

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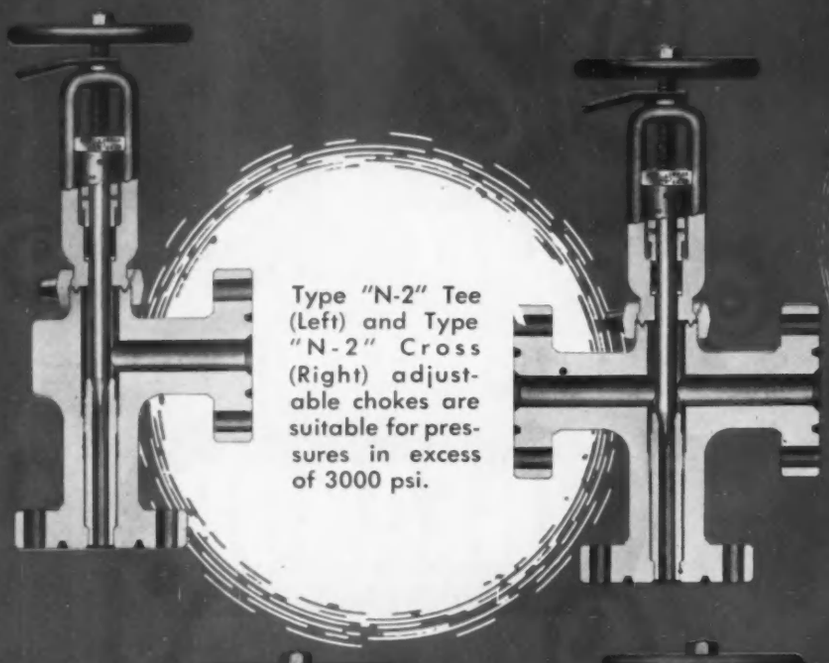
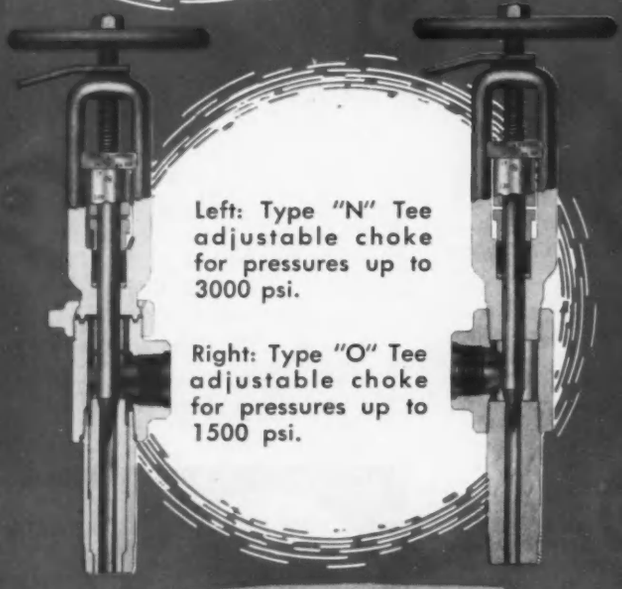
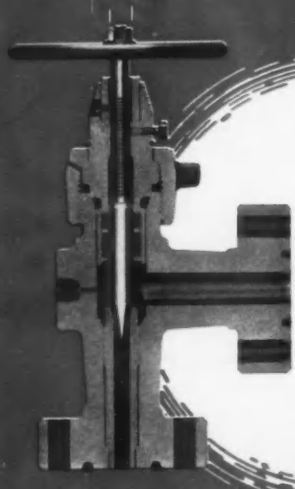


Type "N-2" Tee (Left) and Type "N-2" Cross (Right) adjustable chokes are suitable for pressures in excess of 3000 psi.



Left: Type "N" Tee adjustable choke for pressures up to 3000 psi.

Right: Type "O" Tee adjustable choke for pressures up to 1500 psi.



Type "JW" Tee adjustable choke for pressures up to 10,000 psi.

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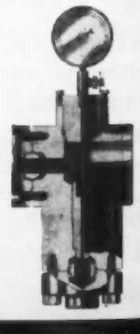
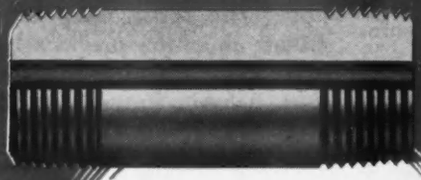


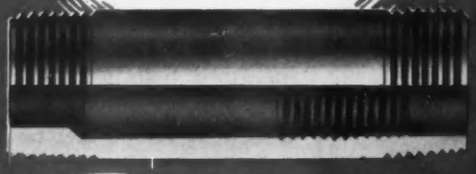
1,500 psi to 30,000 psi

ete line of chokes... and every one is the best of its kind!



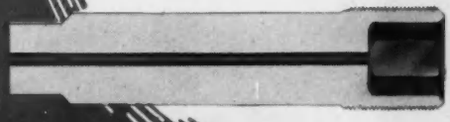
OCT Type "FC-25"
Positive flow beam.

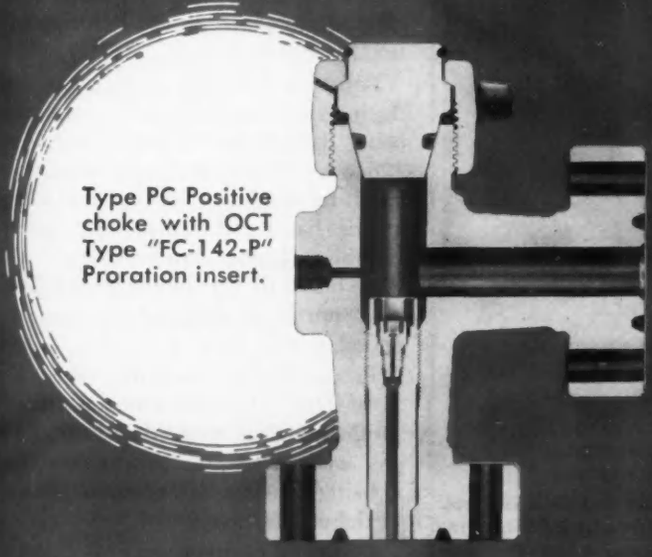
OCT Type "FC-140"
Cage nipple and
flow bean.



POSITIVE CHOKES

OCT makes a complete line of cross and tee choke fittings in all popular sizes and all pressure ratings, as well as a complete line of cage nipples, flow beans, and proration inserts. Most choke fittings will accommodate either positive flow beans or adjustable choke assemblies. This interchangeability reduces the inventory of parts required to service wells in a given field.





Type PC Positive
choke with OCT
Type "FC-142-P"
Proration insert.

OCT Type
"FC-142-P"
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insert.

ALL parts of OCT Chokes are carefully made of materials best suited to the requirements of the well. Precision machining assures maximum safety as well as interchangeability of parts.

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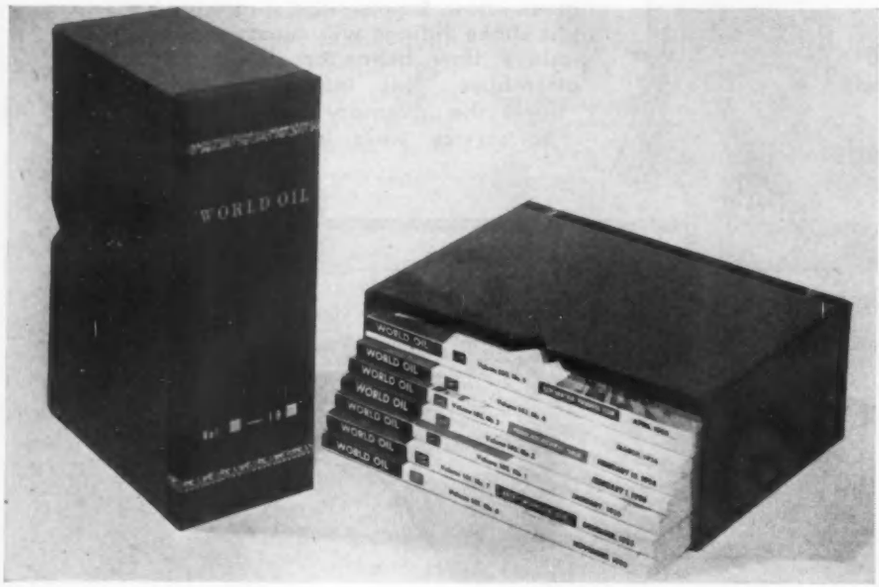
attention to Saudi Arab employes of unusual promise, and to advance them as fast as possible to positions of greater responsibility. The Saudi Employe Development (SED) program was begun in 1955 to foster this objective. A monthly average of 35 Saudi employes received leadership training courses during the year, learning supervisory practice fundamentals.

Aramco continued to encourage its American employes to learn Arabic, and offered courses in company schools at Sidon, Lebanon, and in each Aramco district for this purpose.

During 1955, Aramco spent about $2.5 million on medical facilities. A 66-bed surgical ward and 40-bed isolation ward will both be available to Aramco employes and members of their families when the third wing of the Dhahran Health Center is completed in 1956. The second wing was completed in March, 1955, and a portable building at Dhahran was converted for use as a pediatric ward.

A new Aramco hospital at Abqaiq was nearing completion in early 1956, and construction of a similar hospital is scheduled to start at Ras Tanura this year.



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Bahrain . . . 14 completions hold production steady.

Oil activity in 1955 continued at about the same pace on Bahrain Island as in the previous two years. The operator of the Bahrain concession, Bahrain Petroleum Company, Ltd., a California Texas Oil Company affiliate, announced total 1955 crude production of 10,981,537 barrels, or a daily average of 30,086 barrels. Total crude yield in 1954 amounted to 10,991,754 barrels, 10,217 barrels more than last year. Thus, crude production dropped nine tenths of one percent in 1955.

Drilling footage amounted to 46,084 feet. A major factor in this amount of hole was the completion of the deepest well ever drilled on the island, Well 128. The test, an exploratory hole located on the west flank of the producing structure, was drilled to 11,985 feet in pre-Permian sediments, and was abandoned after logging gas shows in the Permian section.

Fourteen oil wells were completed during the year, and another well was being drilled at the year's end. Well 128 was the only dry hole, aside from structure drilling that was completed in the Fasht Adhom vicinity east of Bahrain. Three structure tests also were being drilled in the Fasht Jarim area north of Bahrain as the year ended.

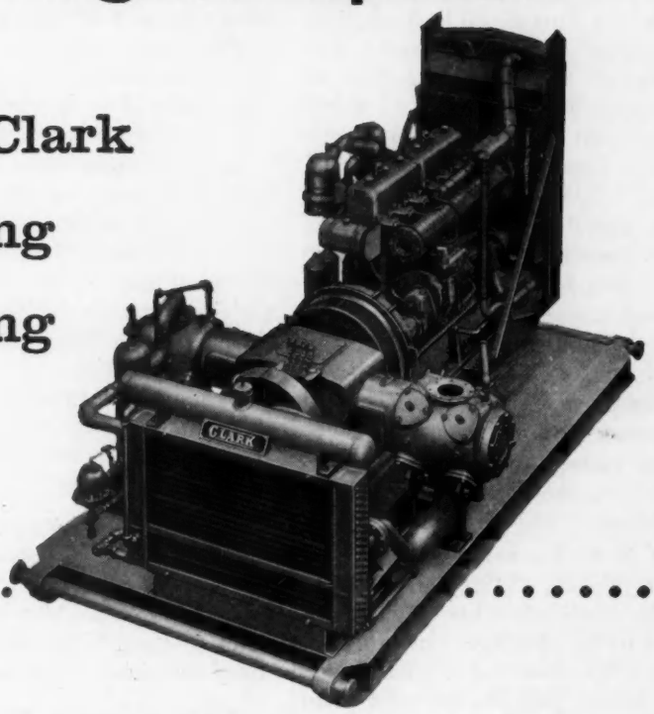
Producing oil wells numbered 106 as of Dec. 31, with seven additional producers shut in at that time. Four gas wells were on production. Gas is being injected to maintain pressure in the oil pay zones.

Crude oil reserves were estimated at 170 million barrels at the end of the year, representing a decrease from previous estimates.

The Bahrain Petroleum Company refinery has a charging capacity of 200,000 barrels daily. A 23,000 barrel daily addition to the vacuum distillation capacity was completed late last year, and the continuing general expansion included a 10,000-barrel-a-day platformer and a naphtha unit of equal capacity, both planned for 1957 operation. The refinery charges locally-produced and Saudi Arabian crudes, and has been running approximately at capacity during the past two years or more.

NOW...a compact 75-200 bhp Packaged Compressor

Designed by Clark for gas lifting or gathering



FEATURES

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Eliminates belts or gear drives.

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Only 7′ 3″ x 15′, rigid heavy "I" beam construction.

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Lower than on most Clark stationary compressors.

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Straight finned tubes. Easy to inspect or clean, inside or out.

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No field assembly. Shipped as a complete unit.

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Five makes of proved engine designs available.

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Use it for gas lifting, gas gathering, gas boosting, pipeline testing, recycle plant feeders, other field services.

You asked for this field compressor—as rugged, compact and perfectly balanced as the famed "Midget Angle" but of half the horsepower.

Now you have it, in the new Clark Model CFA. Rated at 75-200 bhp, this packaged unit is ideal for gas lifting or gathering.

The CFA uses a new specially designed 5″ stroke Balanced/Opposed compressor directly connected to a standard design gas engine. The compressor and engine, together with radiator, scrubber, etc., are mounted on a rugged steel skid measuring only 7′ 3″ x 15′.

The CFA is virtually vibrationless in operation because of its Balanced/Opposed action. In most cases the small amount of concrete used to level the unit will provide ample support. Direct drive eliminates the need for cumbersome belts and gears.

Easily and speedily transported on an average size truck, this new field compressor can also be operated on truck or floating barge.

The CFA is factory assembled, tested and shipped as a complete unit. Because of standardization the CFA can be shipped from stock in most instances.

There is a Clark CFA specialist in your area to give you all the facts. If you require greater horsepower, ask him about the Clark HMA and HMAB.

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Turkey . . . Revised oil law and banner production, refining and pipe line activity recorded in 1955.

THE YEAR 1955 was another banner year for the Turkish oil business, just shifting into high gear. Crude production, all from Raman field in southeastern Turkey, rose to 1,198,500 barrels, or an average of 3284 barrels per day. Compared with the 1954 total of 413,000 barrels, crude yield almost tripled in 1955, increasing by 785,500 barrels or 192 percent above the previous year.

Proved crude reserves were estimated at 85 million barrels at the end of 1955, up 5 million barrels from the previous year. All reserves are owned and operated by the government.

Total footage drilled amounted to 53,660 feet, more than twice 1954's 23,605 feet.

The Batman refinery went on stream July 24, 1955. The plant has a daily crude charging capacity of 6250 barrels. Average runs to stills during 1955 amounted to 1800 barrels daily. Before July 24, the pilot plant was running only 300 barrels per day, so that daily runs to stills after July 24 were on the order of 3700 barrels. Contractor on the Batman refinery work is The Ralph M. Parsons Company, of Los Angeles, Calif.

Pipe line construction activity in Turkey was brisk. More than 450 miles of product pipe lines, ranging from 4 to 8 inches in diameter, were under construction. They will serve North Atlantic Treaty Organization air bases and will move Turkey's remote eastern area production to more populous consumer areas in the central and western parts of the country. Associated Pipe Line Contractors, Techint Inc., Foster Wheeler, and a number of other U. S. and foreign contractors and engineering firms were participating in the construction of this network.

The 12-mile pipe line connection from Garzan field, previously shut in, to the Batman refinery was slated for 1956 completion. Opening this field was expected to increase crude production by 50 percent.

In the broader sense, improvement and clarification of the Turkish oil law, enacted in 1954, and the concessions settlements that followed were the most important events of 1955. Original work on the Turkish law was done by Elmer Batzell of Washington, D. C., a specialist in international legal matters regarding oil, and Ball Associates, consultants. Some of the more important modifications of the law are as follows:

- The drilling obligation imposed on license holders is extended to five years to allow more careful selection of exploratory wellsites. Previous time limit to start drilling was three years from the time the permit is granted.
- The obligation to produce has been tied into relevant economic considerations that will pertain to the specific situation.
- Royalty payments will be based on the oil produced and saved.
- The total of rentals, royalties, charges, custom and other duties will not exceed half the operator's net profits, and profit-sharing will be based on this principle.
- Exemption from customs and other import taxes already recognized has been extended.
- The principle of free transfer of capital and profits has been recognized.
- The requirement for training of Turkish nationals has been eased in the case of temporary activities, such as geologic investigation and exploration.

By the end of 1955, 82 exploration licenses were clarified and granted, and 60 additional permits were being requested early in 1956. The grand total of granted and applied-for licenses at that time was 141, covering 17 million acres.

The following companies have been granted licenses in the number indicated:

Standard Oil (Turkey) Inc., 16; Royal Dutch Shell, 13; American Overseas Petroleum Ltd., 11; Mobil Overseas Oil Company, 11; Turkiye Petrolleri Anonim Ortakligu (51 percent owned by Turkish government), 7; Tidewater Oil, 6; Deilmann Montan GmbH, 4; Istanbul Natural Gas Ltd., 3; D. D. Feldman Oil and Gas, 2; Bolsa Chica Oil Corporation, 2; Gilliland Oil Corporation, 2, and Husky Oil, 1.

Nine districts have been established for the purpose of administrating concession matters. Seven of them have been open to bids. The areas that have shown of greatest interest so far are:

District I, including the Trace Basin, in westernmost (European) Turkey.

District V, along the Iraq border in far southeastern Turkey, in which the country's only current production is located.

District VI, along the Syrian border, west of V.

District VII, in the south-central coastal region, bordering the Gulf of Iskenderun.

District II, in the Salt Desert area south of Ankara.

Exploration activity was increasing in the areas under permit, and at least two wildcats were expected to be started before the end of 1956 by recent concession recipients.

Drilling and Production in Turkey, 1955

REGION	Crude Production in 1955, Barrels	Number of Producing Crude Oil Wells, End of 1955	Number of Gas Wells, End of 1955	Number of Wells Shut in, End of 1955	Footage Drilled in 1955	Number of Wells Drilling, End of 1955	Number of Field Wells Completed in 1955				Number of Wildcats Drilled During 1955	
							Oil	Gas	Dry	Total	Dry	Total
Raman	1,198,500	19	None	10	45,260	1	11	0	2	13	..	..
Garzan	Shut in-None	None	None	8	3,470	3	2	0	1	3	..	..
Reshan	None	None	None	None	4,930	1	..	..	..	..	1	1
Total	1,198,500	19	None	18	53,660	5	13	0	3	16	1	1

Israel . . . First well completed at Heletz, which may prove to be international producing area.

ISRAEL'S FIRST oil discovery was made at Heletz, 30 miles south of Tel Aviv and six miles north of Egypt's Gaza strip, on Sept. 22, 1955 by Lapidot Israel Petroleum Company, Ltd., (Israeli and U. S. interests) and Israel Oil Prospectors, Ltd., (Israeli, Swiss, and U. S. interests).

Heletz, or Huleiqat, 1, found 30.5 gravity oil at 4906 feet in a six-foot lower Cretaceous sandstone. This zone tested 1100 barrels per day. The pay was cased off, and the well was deepened to 4965 feet.

A lower sand, 16 feet thick, and another member of the Nubian sandstone zone, was found to be saturated with 32 gravity oil, and completion was made in the lower zone.

The well tested 500 barrels daily on a 3/16ths-inch choke with bottom hole pressure of about 1850 pounds. The well was on production about 50 days during the end of 1955, and yielded 12,000 barrels. As of the end of April, 1956, producing rate was 265 barrels daily with no water and with pressure on tubing of 136 pounds.

The oil strike, enhancing prospects along the Mediterranean coast in Israel, the Gaza strip, and Lebanon, was of major importance to Israel.

The Heletz field was undergoing rapid development to determine its extent. Heletz 3, 1400 feet northwest of Heletz 1, came in as a producer on March 8, 1956, and Well 2, 1400 feet southeast of the discovery, went on production early in June.

Both stepout wells are similar in production volume and formation characteristics to the first. Heletz 5 was reported ready for production on June 10, with another rig being readied to drill Heletz 7.

It was not known if the new field represented a major reserve, but it was unquestionably an important discovery.

Geological data yielded by virtually all wells completed in Israel in 1955 contributed to a brighter picture. Douglas Ball, of Ball Associates, consultants of Washington, D. C., who did the original geologic work in Israel in connection with the 1952 Petroleum Law, reported that despite the presence of igneous surface exposures in the southern Negev, subsurface data now has shown thick sedimentary sections to exist in virtually all the remaining parts of Israel.

A total of 61,777 feet of hole was drilled in wells completed during 1955, all of them wildcats. In addition, all companies operating in Israel conducted core drilling operations, drilling 61 core holes for a total of 62,049 feet. The most interesting wildcats, other than Heletz 1, were the following:

1. Beeri 1, drilled by Lapidot and Israel Prospectors with the same rig that was later moved to Heletz, bottomed at 11,958 feet in Jurassic.

2. Israel American Oil Corporation's Rekhme 1 at Boqer, 40 miles southeast of Beeri, drilled to just short of 9100 feet in Triassic and which indicated rapid facies changes between the sands and shales it penetrated and correlative hard, dense limestones drilled at Beeri.

3. Tests drilled near Tel Aviv on the coast at Yavne and Petah Tikva, though abandoned, had good gas shows.

4. In February, 1956, Pan Israel Oil Company and Israel Mediterranean Petroleum, Inc's test at Kurnub in the Negev was abandoned at 9040 feet in andesite, reaching apparent basement rocks below a limestone section that was quite thick, considering both the proximity to igneous surface exposures farther south and the big uplifted structure on which the test was drilled (WORLD OIL, January, 1956, Page 197).

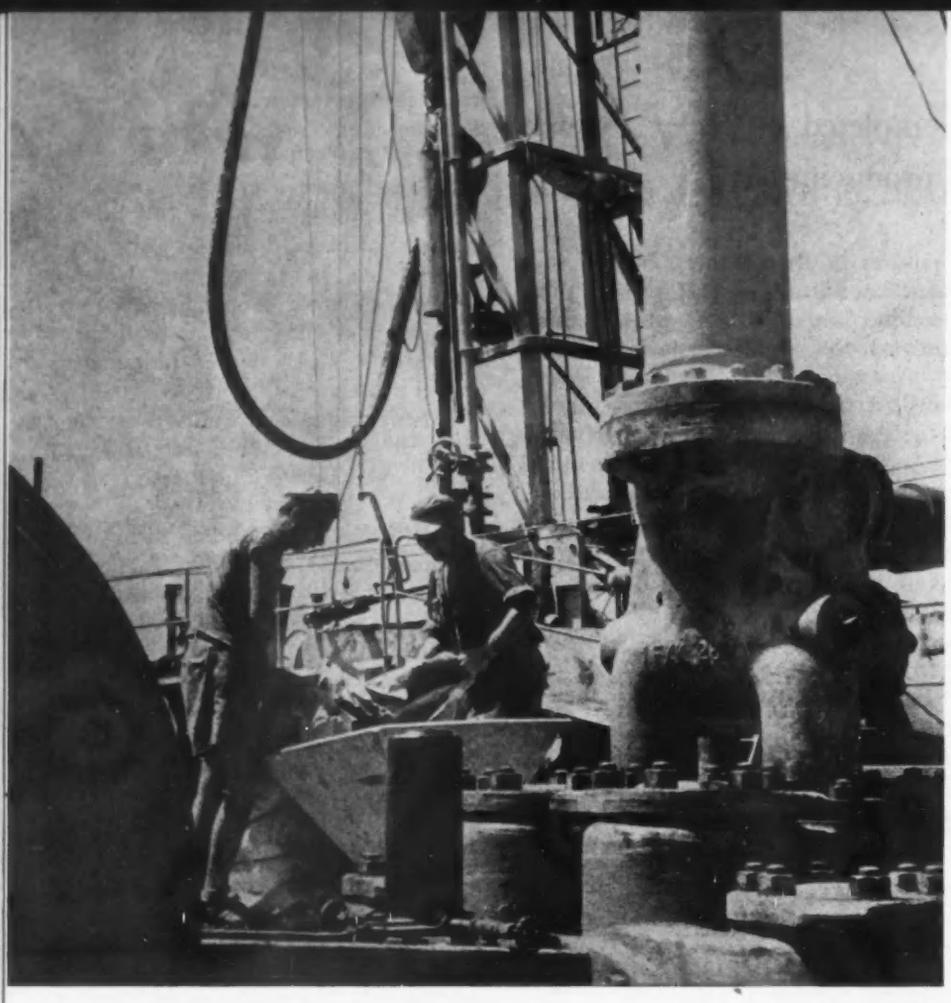
ISRAEL . . . Crude discovery at Heletz improves nation's outlook.

Geophysical work by the Weizmann Institute of Israel continued active, totaling 13 seismic, and 17 gravity party months, as compared with 14 seismic and 24 gravity party months in 1954. Virtually all of the coastal plain and Dead Sea graben have had gravity coverage. Work by both parties was expected to continue through 1956.

At the start of 1956, six rigs were operating in Israel, and it was possible that as many as 13 would be active in the country by the end of the year. Israel hopes to have ten wells producing 2000 barrels daily at Heletz by January, 1957.

A 5-mile, 7-inch pipe line was quickly completed after the Heletz discovery to the railhead at Ashkelon. Crude was being shipped by rail to the Haifa refinery. If production from Heletz justifies the project, a 90-mile pipe line will be built from Heletz to Haifa, but no such project was planned immediately.

During 1956, 800,000 acres were granted in new concessions to two companies entering Israel's oil scene—Naptha Israel Petroleum Corporation, Ltd., and Yellowknife Bear Mines, Ltd. In January, 1956, prior to the new grants, 38 licenses were in force. They covered about 2.8 million acres, 54 percent of Israel's total area, and were held by nine different companies or group units.



A rig being installed at Gan Yavne settlement, 18 miles south of Tel Aviv, by Israel-American Oil Corporation. Another rig on this location was damaged in a gas eruption and subsequently dismantled.

Other Middle East . . . Concessions dot area. German interests drill Yemen's first test.

OIL OPERATIONS in several of the smaller countries of the Middle Eastern area reached the exploration drilling stage during 1955 and 1956. While the larger producing nations of the area had entered the development phase, several oil companies were optimistic about prospects in the smaller countries. A summary of operations in these regions follows:

Trucial Coast, Abu Dhabi. Petroleum Development (Trucial Coast) Ltd., an affiliate of Iraq Petroleum Company, Ltd., carried on active exploration along the Trucial Coast during 1955 and 1956. Gezira 1, an onshore location in an area claimed both by Saudi Arabia and the Sheik of Abu Dhabi southeast of the neck of the Qatar peninsula, was spudded Jan. 20, 1955. By the end of the year, the well had reached 12,500 feet. It was abandoned in 1956, reportedly having reached the Arab zone of the Jurassic without encountering any porosity.

No drilling was reported in the Murban area, where high-pressure gas and oil shows were encountered in 1953, but the area is said to be still under investigation. The test drilled there three years ago was abandoned.

Considerable seismic, gravity, magnetometer, and underwater geologic work was done off Abu Dhabi by The British Petroleum Company, Ltd., jointly with Compagnie Francaise des Petroles in 1954, continuing into 1955 and 1956. George Wimpey and Company of London is doing the most recent work off Abu Dhabi, about 50 miles offshore. The 1200-ton ship Astrid Sven is specially equipped with a drilling platform which is cantilevered over the ship's side abreast of the forward wall deck, for shallow drilling at the sea bottom.

Last year, the vessel Sonic carried out a rapid seismic survey along the Trucial Coast in depths of from 10 to 100 feet. This converted wartime LCS(L) was able to work shot-lines as long as 65 miles per day, detonating as many as 300 shots daily for reflection work and recording about 30 shots per day while doing refraction seismic.

On July 2, 1956, British Petroleum announced that it, with two-thirds, and Compagnie Francais des Petroles, with one-third interest in the venture, would jointly drill a deep test 20 miles off the island of Das. This island lies 60 miles off the mainland in the Persian Gulf, and will serve as a base camp for this operation. Name of the company formed for this and other possible future ventures is Abu Dhabi Marine Areas, Ltd.

The rig is rated to 15,000 feet and will be mounted on a barge mounted on retractable steel legs. Depth of water at the location is 50 feet. Cost of the operation through completion of the first well is estimated at $14 million.

Jordan. On Feb. 5, 1956, the concession negotiations of Edwin W. Pauley, independent oil operator of Los Angeles, Calif., covering all of the Kingdom of Jordan's 34,750 square miles, were completed. After considerable discussion, the agreement was signed by King Hussein II and was officially published in Jordan.

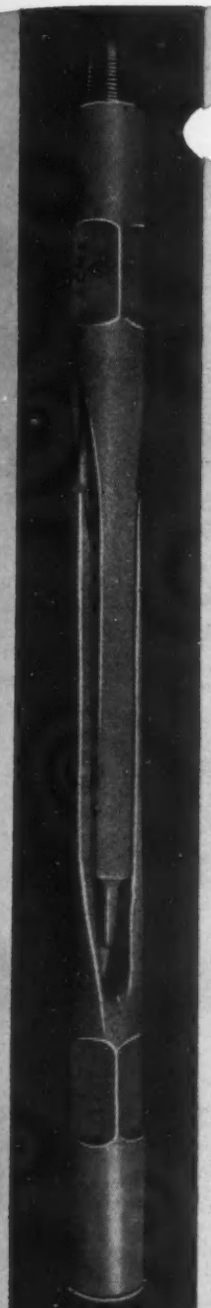
Terms of the agreement follow:

- Pauley must relinquish two-thirds of the area by Oct. 2, 1956, retaining the remainder for development.
- Pauley must drill at least 20,000 feet of hole annually.
- The government's royalty is 50 percent, after Pauley recovers his costs.

A rig was expected to be in Jordan by the end of 1956. Gravity and surface geologic work were in progress early this year, and a seismic crew was to be operating by mid-1956.

Large surface structures are present,

"are YOU getting ENOUGH FOOTAGE?"



1. To MAKE MORE MONEY you have to get a higher price for your drilling, or get more drilling from your machine and tools. The progressive drilling contractor is always after both—more money and more footage.

2. To get you MORE FOOTAGE, Acme spent more than a decade developing a superior alloy jar. How? By the same quality methods that have made the Acme Carbon Jar victorious over all competition. Today over 85% of the carbon jars made in America are Acme and they wear as long as a competing weldless jar in many sizes.

3. To get LONGER WEAR — much longer wear — in all formations, the Acme alloy jar has been perfected. Look up the word Acme in your dictionary; it comes from the Greek word, Akme, meaning perfection, peak of progress. Here is how we live up to our great name.

4. We have installed the MOST MODERN EQUIPMENT to manufacture jars. Exclusive with Acme are the latest technological improvements in the physical treatment and welding of jar steel. No one else offers you the benefit of such superior manufacturing facilities. Acme Alloy Jars — like Acme Carbon Jars — are superior because they are made by superior methods and machinery.

5. We use SUPERIOR STEEL in Acme Alloy Jars. It is a triple strength alloy steel, grade AISI 4340 made out of chromium, molybdenum, and nickel. It is a longer wearing alloy steel than the single alloy used in a competing make. Acme Alloy Jars have 1300% more alloy in them than any other make on the market. We use a chrome-moly-nickel steel which is rich in nickel, producing a greater depth of hardness penetration than the single alloy used by a competing make. LONGER WEAR is the bonus you get from the superior alloy steel in Acme Alloy Jars.

6. We use ATOMIC AGE WELDING methods. The welding techniques of today permit use of alloy steels far superior to those used at the time weldless jars were first made. The atomic age has made the weldless method obsolete. We put one electric weld in a set of Acme Alloy Jars. It is stronger than steel. The weld is X-rayed by an electro-magnetic process so that no bad welds can get past inspection. This one weld is in the crotch where the steel is 50% heavier than in the rein section. Both sections of the jars are drop forged. This method of making alloy jars enables Acme to use a superior alloy steel, and you get a superior alloy jar with less breakage and longer wear.

7. Acme, like its parent company, Stardrill-Keystone, has a basic policy of QUALITY FIRST. While another manufacturer of alloy jars uses an alloy steel containing only ⅛ of 1% alloy content, Acme, in its alloy jars, uses a steel containing 3% of alloy — or 1300% more.

8. Acme gives you MORE STEEL. For example our 5½" Acme Alloy Jars weigh 425 lbs. . . . 10% more than a competing make. At the same price.

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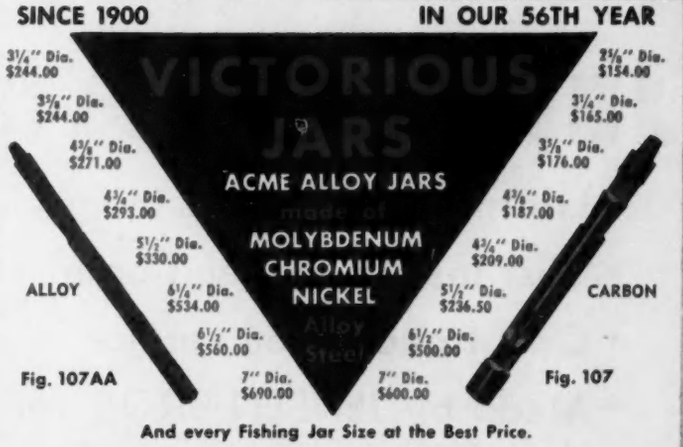

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a favorable stratigraphic section is indicated, and oil seeps have been noted.

Aden. The Aden refinery, owned by The British Petroleum Company, Ltd., and operated by its subsidiary, Aden Petroleum Refinery, Ltd., ran an average of 87,000 barrels of crude to stills during 1955, slightly less than capacity, rated at 100,000 barrels per day.

The plant was commissioned in July, 1954, but construction was continuing. LPG plant was being completed in March, 1956, a thermal reforming unit was planned, and the water cooling supply was being extended.

The reformer will have a capacity of 8000 barrels daily, and will upgrade gasoline from the two big distillation units now operating.

The LPG will be marketed locally and in nearby Somaliland, Ethiopia and the Sudan.

Oman. By December, 1955, Petroleum Development (Oman) Ltd., an Iraq Petroleum Company affiliate, had erected a rig at an extremely remote location called Jebel Fahud in disputed territory between the Sultanate of Muscat and the Imamate of Oman. Location is 22° 17′ N 56° 37′ E in the far southeastern part of the Arabian peninsula. By May, 1956, the well had reached 4400 feet with a tentative depth of 6000 feet projected.

The location was accessible only with great difficulty. Much of the stores and equipment was routed 900 miles by sea from Umm Said, Qatar, to Ras Duqm (not a deep-water harbor) on the southeast coast, and trucked over a difficult 350-mile route to the wellsite. Also, 129 tons of drilling equipment, including a 13.5-ton drawworks, was airlifted from Umm Said.

Dhofar. Dhofar-Cities Service Petroleum Corporation operates a 32,000-square-mile concession along the southern coastal area of Arabia in Muscat and Oman. The concession is held jointly by Cities Service Oil Company and Richfield Oil Corporation. An aerial photographic survey has been completed and surface geological parties have been active.

The first test was drilled in 1955 at Wadi Dauka, located in the interior at 18° 39′ N 53° 59′ E. This well was drilled to 11,776 feet in Paleozoic strata, without encountering oil or gas in commercial quantities, and was completed as a sweet water well at 1900 feet.

The rig has been moved to a second location, 80 miles southeast of Wadi Dauka. In May, 1956, the well was drilling below 2000 feet.

Seismic exploration also was underway early in 1956.

Yemen. This remote kingdom, located in the extreme southern portion of the Arabian peninsula between Saudi Arabia and Britain's Aden Protectorate and bordering the Red Sea to the west, became of importance to the oil world in 1955 and 1956.

Yemen is a living museum peopled by 5 million people whose remote mountain capital, San'a, has 300,000 inhabitants. The nation reached its peak in the Sixth Century B. C., has advanced little since, but has been conquered by nobody. In 1955, Deilmann interests of Bentheim, Germany, received a permit to explore the Red Sea coastal strip between Hodeida and Maidi, and moved in a rig in early 1956 to drill Yemen's first oil test.

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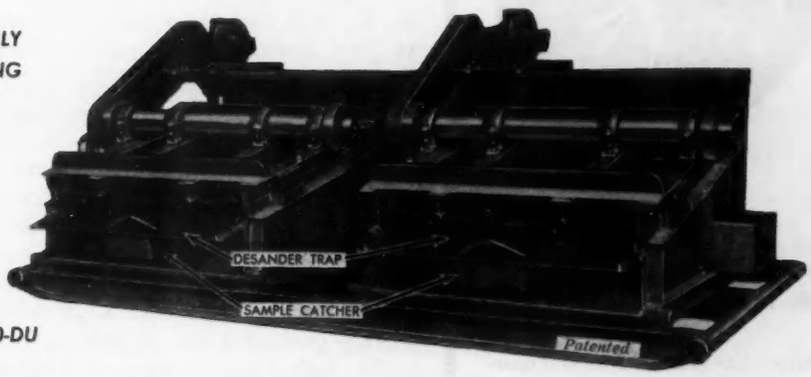

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WRITE FOR BULLETIN 4B

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began surveys of the Kamaran Islands in the Red Sea off Yemen late in 1955. Yemen reportedly has contested the British contention, however, that these islands properly fall within the Aden Protectorate's jurisdiction.

The largest concession in Yemen was negotiated in late 1955 for Yemen Development Corporation, consisting of 40,000 square miles or roughly the northern two-thirds of the country. Oil and Gas Property Management, Inc., of Dallas, Texas, owns 50 percent interest in Yemen Development Corporation. Walter S. Gabler and George E. Allen, of Washington, D. C., and Empire Trust Company of New York also are participating in the venture.

The concession, effective November 2, 1955, granted by King Imam Ahmad, gave Yemen Development a 30-year right to explore for and develop oil, in return for bonus, royalties, and a split of profits adhering to the 50-50 principle as agreed upon between the two parties. A party of surface geologists was in Yemen.

The Safir Basin, adjoining the Aden Protectorate, currently is considered the most prospective area, but very little is known about the interior of the country. It was expected, however, that the geological section will be similar to neighboring Saudi Arabia's as revealed to some extent by Arabian American Oil Company's recent work in the Rub al Khali, the "Empty Quarter" in southern Saudi Arabia.

SYRIA. Negotiations during 1955 between J. W. MenHall, independent producer and drilling contractor of Benton, Ill., and the Syrian government concluded with MenHall's receipt of 28 exploration permits covering 117 square miles each. The area, not contiguous, total 3276 square miles. All were requested on the basis of local conditions, primarily surface geology, in northern and northeastern Syria.

The permits were for four years from May 27, 1955, renewable for four years. James W. MenHall and associates own 100 percent interest in the permits. Portsmouth Steel Corporation of Cleveland, Ohio, has a financial interest in the venture on the order of $200,000, pursuant to an early agreement between MenHall and Cyrus S. Eaton, who heads Portsmouth.

A wildcat was spudded by MenHall, et al, in the Karatchok area, in far northeastern Syria, within six miles of both the Turkish and Iraq borders, on April 30, 1956. By May 23, the well had been drilled out beneath 325 feet of 16-inch surface casing and had reached 2800 feet by the last week in June.

The area is within 30 miles of the Ain Zalah oil field in Iraq and is on the same general Cretaceous trend with that field and also Raman field in Turkey. Top of the Cretaceous was expected at from 5000 to 5500 feet. The well is being drilled on a prominent surface structure with a rig capable of drilling to 12,000-15,000-foot depths.

The Syrian government was considering offers from refinery constructors in the U. S., Britain, France, Soviet Union, Czechoslovakia and Rumania. Tentatively, the plant would be built at Homs, would cost $3 million and have a capacity of 12,000 barrels daily.

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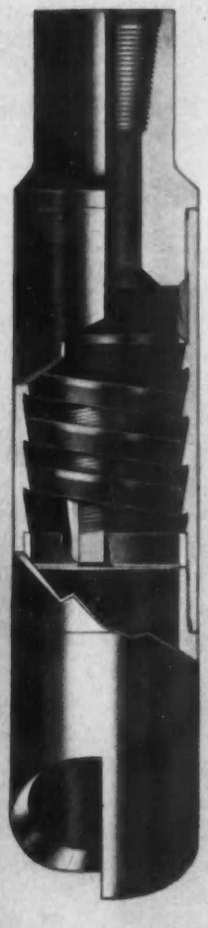

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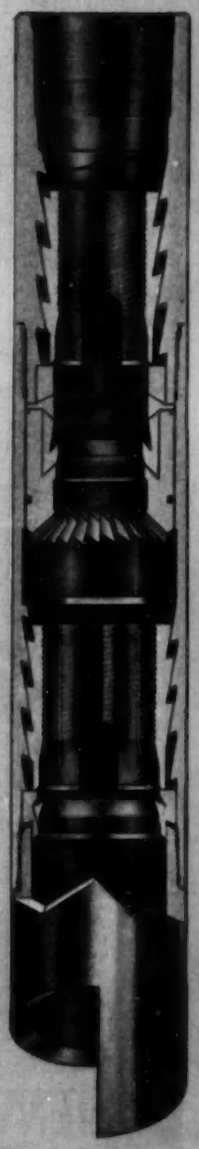

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Burma . . . War-ravaged industry boosts crude production 4.3 percent. Refinery construction underway.

THE OIL INDUSTRY in Burma, wrecked during World War II and restored only partially and painstakingly since, continued to show moderate progress in 1955. Total crude oil production was 1,617,500 barrels, an average of 4432 barrels daily. This includes production from Yenangyaung field by local operators.

In 1954, the total crude production was 1,550,000 barrels, or 4247 barrels per day. Thus, crude production in 1955 increased by 4.3 percent over 1954. Cumulative production at the year's end was put at 295,381,000 barrels.

Burma Oil Company (1954) Ltd. has under construction a refinery at Syriam, near Rangoon, to have a capacity of 4000 barrels daily when completed. The Syriam construction will replace, though not equal, the pre-war refinery, destroyed during hostilities. The former Rangoon refinery had a capacity of 20,000 barrels daily.

The company's topping plant at Chauk, rated at 3000 barrels daily capacity, continued in operation throughout the year. Chauk is 300 miles inland from Rangoon, on the Irrawaddy river. An oil pipe line parallels the course of the river on the east side, connecting Chauk and Yenangyaung oil fields with Rangoon, which is about five miles inland from the Bay of Bengal Coast.

Since 1954, when an agreement between three British-owned companies and the Burmese Government was signed, virtually the entire domestic industry has been in the hands of The Burma Oil Company (1954) Ltd. This company is owned 33 percent by the Burmese Government, and this portion may be increased by the government at any time at its discretion. The remainder of the ownership of the company is held by The Burma Oil Company, The Indo-Burma Petroleum Company, and The British-Burma Petroleum Company.

India . . . With crude production rising, Assam concentrates exploration in upper Brahmaputra valley.

RISING CRUDE production and an expanded exploration program combined to highlight India's petroleum industry operation during 1955 and early in 1956.

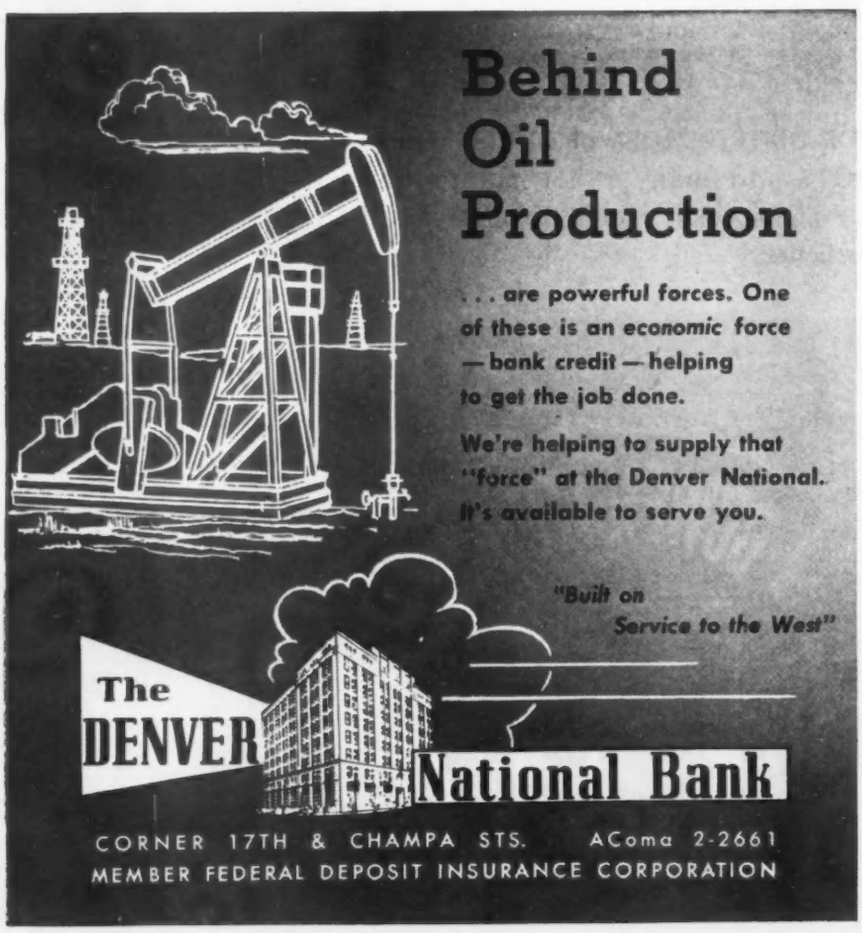
The nation's crude output, which climbed last year to 2,526,000 barrels for a total of 6920 barrels per day, represented a 13 percent boost from 1954 crude production of 2,235,000, or 6126 barrels a day. All of India's current oil is produced by Assam Oil Company from the old Digboi field, discovered in 1889 but recently extended, and the Nahorkatiya field, discovered in 1954.

All production is located in the upper Brahmaputra river valley of northeastern Assam, where the company's current exploration program also is concentrated. At Digboi, Well 970 in East Kharjan extension area, proved to be the best producer yet completed in the field.

Five new wells were completed last year to evaluate the new Nahorkatiya field, and two were dry holes. Ten Nahorkatiya wells had been finished by year's end, six of which appeared to be good producers. A 7 million-barrel reserve is indicated. Production of the 35-gravity crude is from Oligocene sandstone at 10,000 feet. The field is connected with Assam Oil's Digboi refinery by a 23-mile, 8-inch pipe line.

Total cumulative production in India at year's end, including that from the abandoned Badapur field, was 57,222,000 barrels.

Exploration. Active reconnaissance exploration highlighted new 1955 and 1956 activity. Reflection seismic work by two Assam Oil parties was continued in the upper Brahmaputra valley. It had been suspended from May to October, 1955. A deep test at Moran, 25 miles southwest of Nahor-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katiya, was under way in 1956.

In the Bengal basin, Standard-Vacuum Oil Company was active in following up previously-defined airborne magnetometer leads with a helicopter-borne gravity survey. Stanvac's 20,000 square-mile concession in the Bengal basin consists of two contiguous blocks of 10,000 square miles each, lying in India and East Pakistan, respectively.

In December, 1955, an aeromagnetic survey was begun of 20,000 square miles in West Rajasthan, Northwest India, and was scheduled for completion in April, 1956. Based at Bikaner, the project was financed under Canada's Columbo plan. An amphibian was used, with a Gulf high-sensitivity magnetometer mounted in the tail of the aircraft. In May, 1956, it was announced that the survey would be extended to 10,000 square miles of the Ganges basin, with specially-modified DC-3 flights based at Calcutta and New Delhi. Findings were to be reported to the Geological Survey of India and to the Indian Planning Commission, along with technical advice to these agencies.

The Indian government established an Oil and Gas division under the Ministry of Natural Resources and Scientific Research last year and became more active in oil matters. The nation's current domestic demand amounts to 135,000 barrels per day, 95 percent of which is furnished by imports largely from the Middle East and Indonesia.

The government in 1955 announced plans to spend approximately $18 on a five-year exploration program in a 5000-square-mile area near Jaisalmar. The program initially will be limited to the single area in northwestern India along Pakistan's eastern border; however, the effort may be expanded to other areas later.

A geological survey team from Andhra University, exploring for natural gas in behalf of the government, was conducting operations in the Amalapuram area of East Godavari.

Foreign Assistance. Russia has been active in affording both technical and material assistance to India. A three-man Russian team conducted a survey of India's oil potential and submitted its final report to the Indian government in April, 1956. Russia has committed itself to supply large volumes of finished steel to India during the next several years, including mining and drilling equipment. Two of the three Russian rigs, part of a larger order contracted for by India, were scheduled to arrive by the end of this year. The third is expected to be delivered in 1957.

Refining. Caltex Oil Refining (India) Ltd. commenced construction of its Visakhapatnam refinery, scheduled for early 1957 completion.

Assam Oil Company was reportedly considering construction of additional refining facilities in Upper Assam if current drilling develops enough new production to justify refinery expansion or new construction. A new Assam Oil Company refinery at Calcutta also has been under consideration.

Standard-Vacuum Oil Company, Royal Dutch Shell and California Texas Oil Company Ltd. reportedly have reached an accord with the Ceylon government involving the construction of a $40 million refinery at Hendola. This would be the first refinery in Ceylon.

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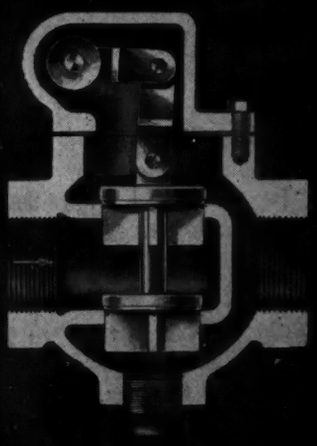

TYPE 9G—an economical and simple separator back pressure valve.

SIZES — Screwed 2", 3" and 4".
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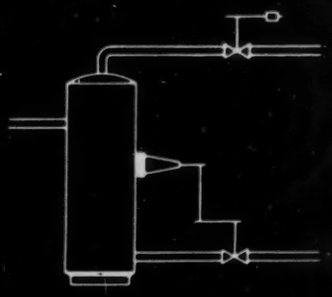
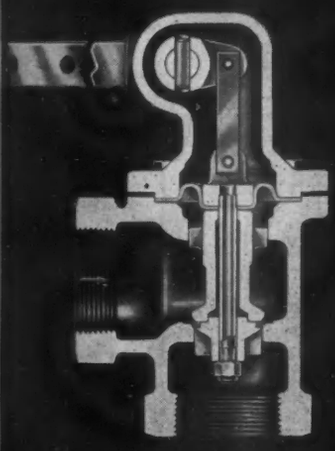


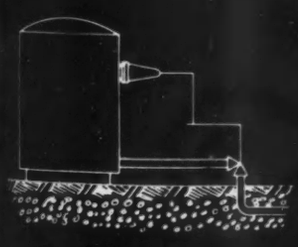
Low Pressure Separator Back Pressure Valve

OIL VALVE

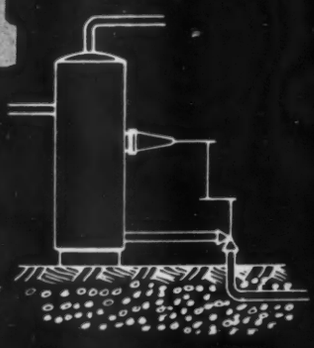


TYPE 1907 — for low pressure oil and gas separator. Also very successfully used as a water dump valve.

SIZES—Screwed 2" and 3".
Flanged—2", 3" and 4".

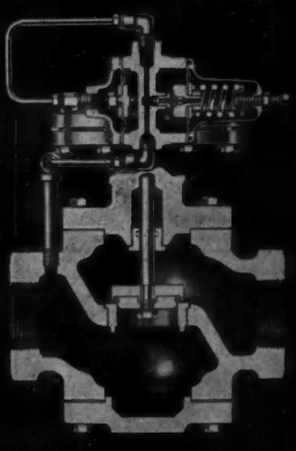


Water Dump Valve On Tank



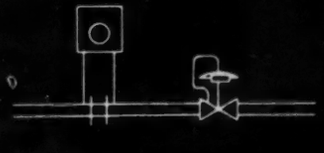
Separator Low Pressure Oil Valve

BACK PRESSURE VALVE

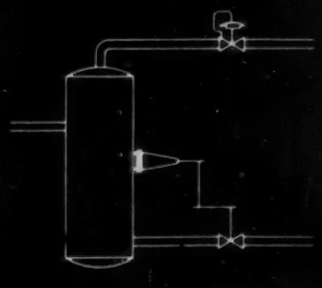


TYPE 63—here's a pilot operated valve that will give close regulation and tight shut-off.

SIZES—Screwed 2".
Flanged—3" and 4".



Field Back Pressure Valve



Separator Low Pressure Back Pressure Valve

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Japan . . . Gravity and seismic surveys off Japan

Sea coast to be part of increasing exploration activity.

WITH DAILY CRUDE production hovering at the 6000-barrel plus level during 1955 and 1956, Japanese petroleum industry activities are highlighted by the current trend of increasing exploration. Although 1955 surface geological exploration declined slightly from 1954, seismic activity increased to 54 party-months last year.

This increasing trend was expected to continue throughout 1956 and to include gravity and seismic surveys off the Japan Sea coast. Surface geology was being concentrated at Hokkaido, where the possibilities of oil production from the Cretaceous were being studied.

One of the major areas of exploration during 1955 was the Kanto plains, in the center of which Tokyo is located. Early in 1956, surface geological surveys were conducted in the mountains, where some oil indications previously had been found. Currently under way are seismic surveys crossing the plains area. To further this program, the Japan Petroleum Exploration Company in 1956 was considering the importing of equipment and techniques from the U. S. and Germany.

The Ministry of International Trade and Industry's plans to establish a new company to conduct exploration activities on a large scale by investing government capital reached fruition in December, 1955. The Japan Petroleum Exploration Company was established by a law which the Congress approved in August, 1955. The exploration program scheduled to be conducted by the new company was begun in December.

Half of the capital of Japan Petroleum Exploration was furnished by the government. At the same time, subsidies for petroleum exploration, furnished by the government under the conservation law, were altered. Japan Petroleum Exploration assumed exploration rights from Teikoku Oil Company. Also, the import duty on crude and fuel oil was resumed, except in special cases. The rate is 2 percent for crude and 6.5 percent for fuel oil.

1955 Operations. During 1955, 80 development wells were completed, and 12 were dry. Twenty-two field exploration wells were drilled, with 13 resulting in failures. Fifteen wildcat wells were completed, and only one furnished small production.

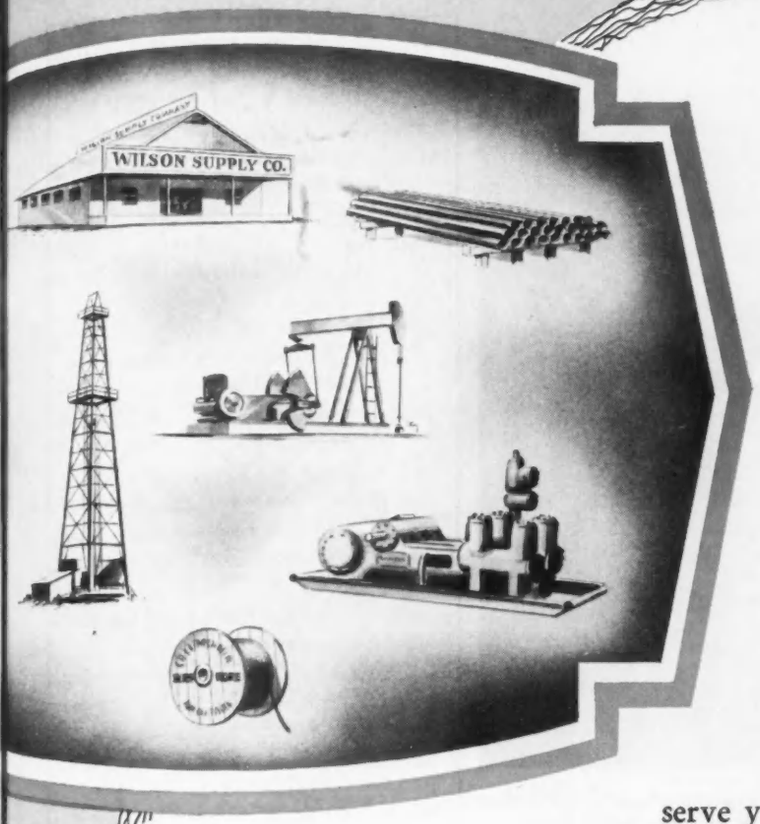
The successful wildcat test was drilled to 1969 feet at Daihango in the southern part of Akita Prefecture, and initially produced at a rate of 7 barrels daily from 1640 feet. Preparation was under way for the drilling of a deeper test. Teikoku Oil drilled a deep test in Yabase oil field, to 10,270 feet for a record postwar deep test, but no new producing zone was discovered.

Average daily crude production last year of 6105 barrels amounted to a daily increase from 1954 of 194 barrels. This rise resulted from development of the southern extension of Yabase oil field's deeper zones.

The program of reservoir pressure maintenance by gas injection was being continued in the northern part of the field, and a compressor plant was being built in the central section. Since the results obtained by water-

Oil Production and Drilling in Japan

COMPANY	Crude Production During 1955 By Region (Barrels)	Natural Gas Production During 1955 By Region (Cubic Feet)	No. of Crude Producing Wells at End of 1955 By Region	No. of Natural Gas Producing Wells at End of 1955 By Region	No. of Wells Shut in as of December 31, 1955	Amount of Footage Drilled During 1955 (In Feet)	No. of Wells Drilling at December 31, 1955	Number of Field Wells Completed During 1955 and Results			No. of Wildcat Wells Drilled During 1955 and Results		
								Oil	Gas	Dry	Oil	Gas	Dry
Teikoku Oil Co.													
Hokkaido	21,438	28,176,000	220	..	3	8,749	1	..	..	..	..	..	..
Akita	1,715,850	568,907,000	1,509	..	137	297,892	14	42	3	13	1	..	9
Yamagata	115,354	12,250,000	72	..	17	36,575	2	7	..	5	..	..	3
Niigata	294,246	1,649,846,000	1,269	75	91	110,873	11	26	3	6	..	..	2
Daido Oil Co.													
Akita	3,596	.....	9	..	1	.....	..	..	..	..	..	..	..
Niigata	2,807	.....	17	..	4	.....	..	..	..	..	..	..	..
Nippon Pet. Mining Co.													
Akita	1,678	.....	16	..	4	.....	..	..	..	..	..	..	..
Nihon Kogyo													
Akita	2,440	.....	5	..	1	.....	2	..	..	..	..	..	..
Others	71,200	.....	395	..	..	.....	1	..	..	..	..	..	..
Niigata Kotsu Co.													
Niigata	.....	191,884,000	....	13	..		..	..	..	..	..	..	..
Nihon Sakusen Co.													
Niigata	.....	648,108,000	....	28	5	3,771	2	..	3	..	..	..	..
Hokuriku Gas Co.													
Niigata	.....	.....	....	..	..	.....	..	..	..	..	..	..	..
Nihon Light Metal Co.													
Niigata	.....	81,601,000	....	12	3	2,461	..	..	1	..	..	..	..
Kyoei Kogyo Co.													
Niigata	.....	182,639,000	....	10	0	.....	..	..	..	..	..	..	..
Nitto Boseki Co.													
Niigata	.....	204,808,000	....	10	7	.....	1	..	..	..	..	..	..
Otaki Natural Gas Co.													
Chiba	.....	405,895,000	....	35	30	14,463	..	..	8	..	..	..	..
Nihon Natural Gas Co.													
Chiba	.....	210,678,000	....	27	3	6,463	1	..	4	..	..	..	..
Koto Natural Gas Co.													
Tokyo	.....	81,755,000	....	7	2	6,445	..	..	1	..	..	..	..
Others	.....	1,210,446,000	....	255	162	62,405	16	..	45	9	..	..	..
Total	2,228,609	5,476,993,000	3,512	472	470	547,097	51	75	95	33	1	..	14



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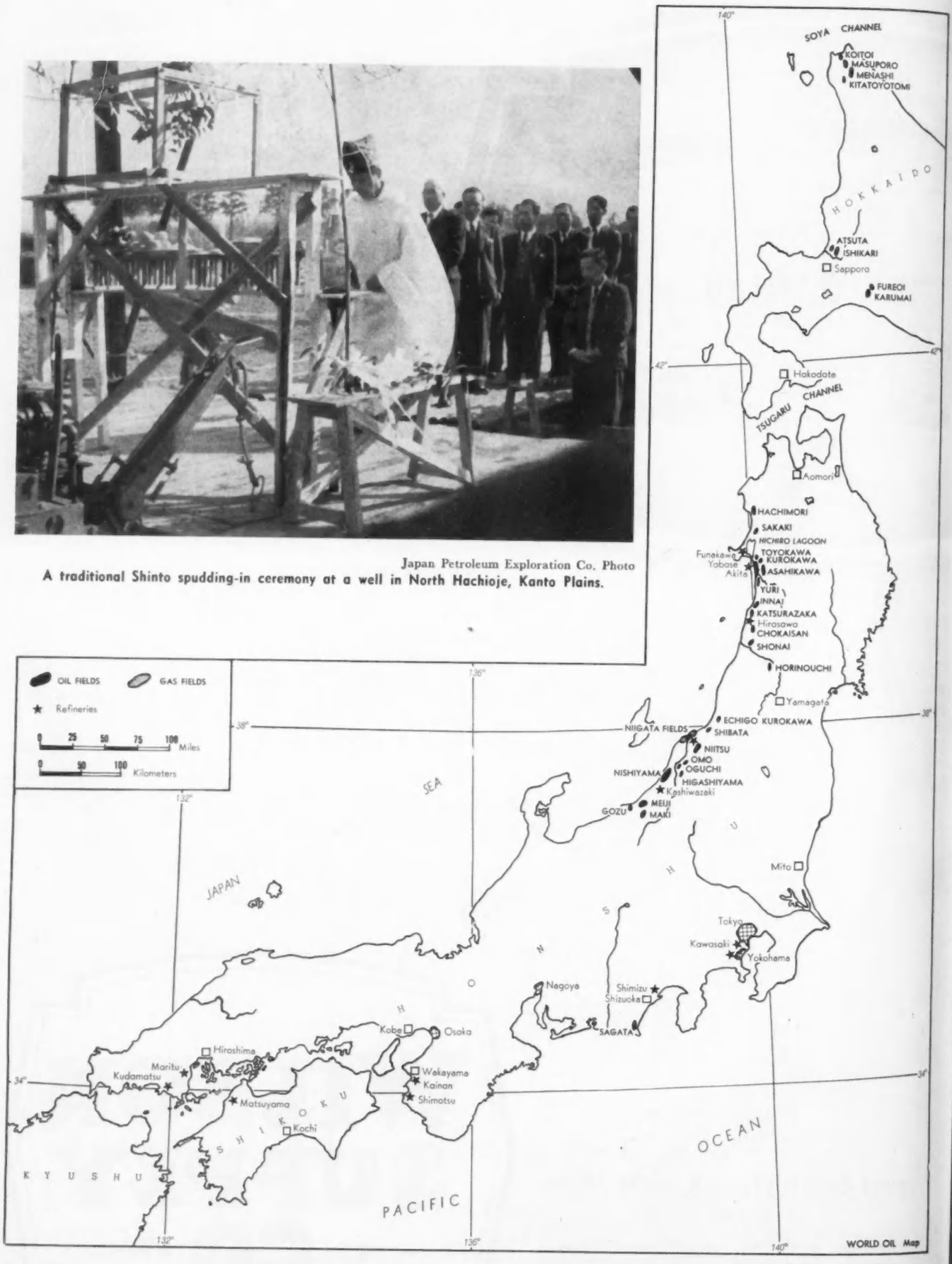
Japan Petroleum Exploration Co. Photo

A traditional Shinto spudding-in ceremony at a well in North Hachioje, Kanto Plains.



JAPAN . . . One of the major areas of exploration during 1955 was in the vicinity of Tokyo, on the Kanto plains, and seismic operations were scheduled to be conducted in 1956. These studies are aimed at increasing daily crude production which has remained for two years at the 6000-barrel plus per day level.

flooding in Zone III of Yabase field were favorable, plans were being made to include Zone IV in the program. Similar plans for Zones VIII and IX were under consideration; however, the reservoir formations are volcanic origin and contain considerable bentonic tuff. Meanwhile, tests were continuing in an effort to fracture low permeability reservoirs.

Producing Wells. At year's end 3512 oil wells and 472 natural gas wells were reported producing, with 470 wells shut in. Those figures compare with the 1954 end-of-year report of 3530 oil wells and 732 natural gas wells producing, with 463 shut in. Natural gas production for 1955 amounted to approximately 5477 Mmcf.

With 51 wells drilling as of December 31, 1955, total footage for the year amounted to 547,097 feet, or an average of 2510 feet per well for the 218 well completions. In 1954, 206 wells were drilled 506,247 feet for an average depth of 2458 feet. Thus, in one year the average depth increased 52 feet.

Of Japan's 218 completions last year, 76 were oil producers, 95 were gas wells and 47 were dry holes. By comparison, records for the previous year showed 92 oil wells, 78 gas producers and 36 dry holes.

Refinery modernization was reported at the Wakayama plant of Toa Nenryo Company and the Shimozu installation of Maruzen Oil Company. Capacities were further increased during 1955 at the Funakawa refinery of Nihon Kogyo Company and the Marifu plant of Koa Oil Company. Additional refining facilities were under construction by Nippon Oil Company at Yokohama and at Kudamatsu as well as by Showa Oil Company at Kawasaki.

Refinery throughput capacity at year's end was 284,000 barrels per day, up from 200,937 barrels daily in 1954. Daily average crude runs to stills last year amounted to 150,547 barrels with 19 refineries in operation.

Consumption of petroleum products in 1955 reached 169 million barrels, up 9.6 percent from 1954.

Imports of 53.8 million barrels last year, 15 million barrels of which was imported as refined products, came primarily from the Middle East. Foreign currency allotted to the petroleum imports fund amounted to $150,579,000.

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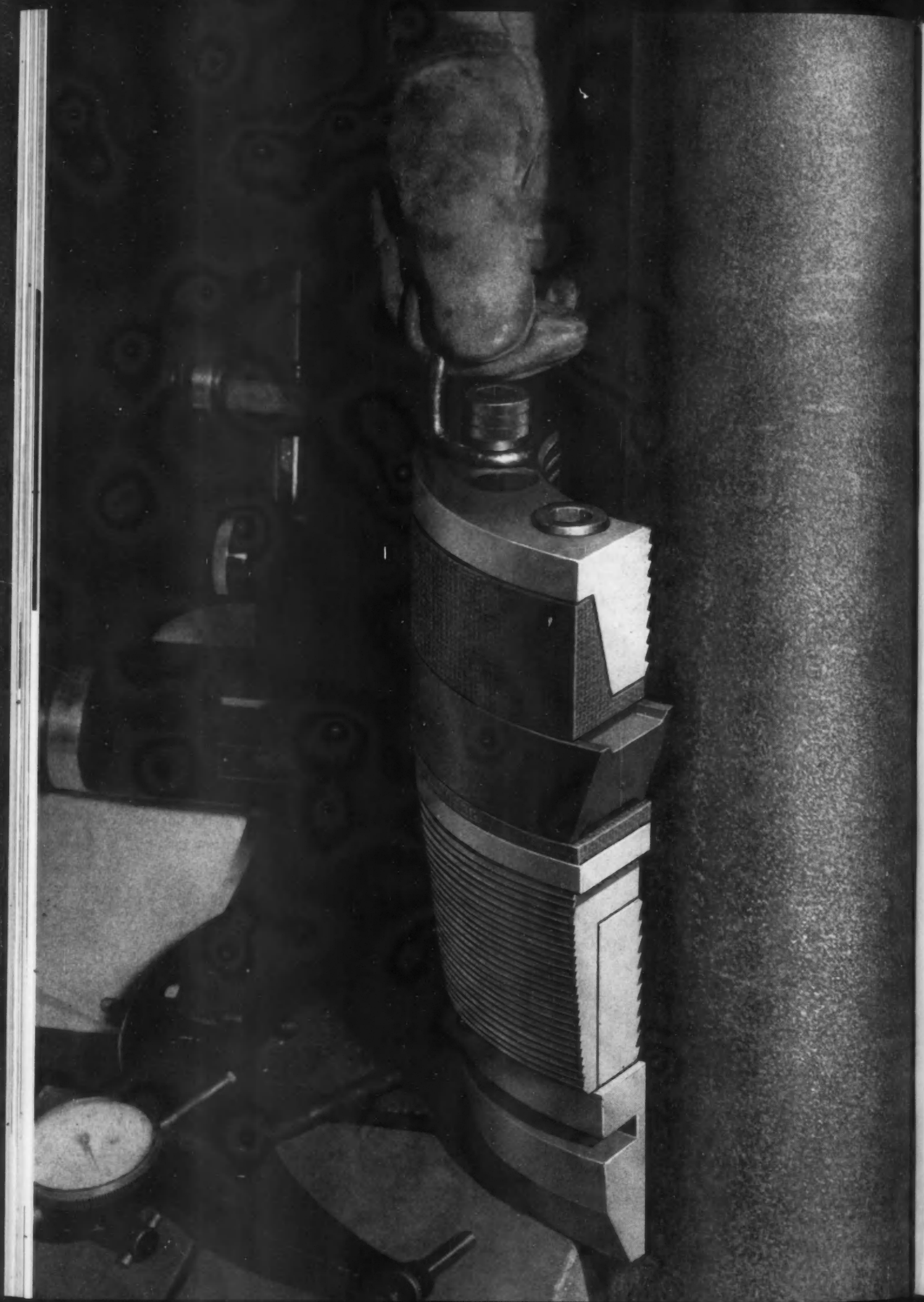

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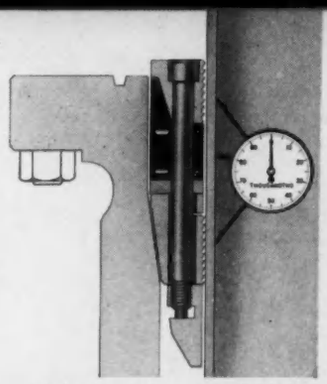
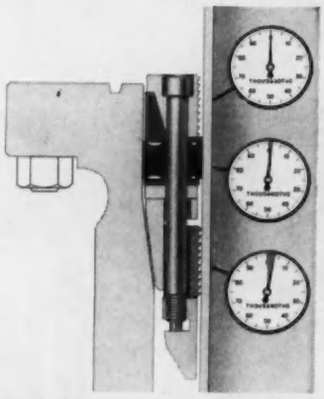
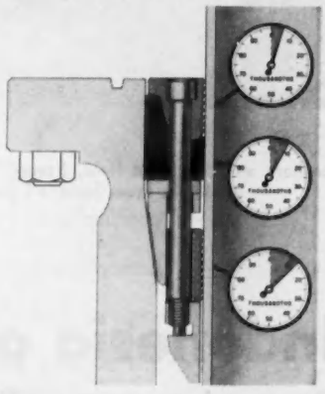


● **INITIAL CONTACT — NO PIPE LOAD —** Segmented floating bowl will not set prematurely, but provides instant gripping upon contacting the taper in the casing head.



● **LIGHT PIPE LOAD, YET SEAL IS EFFECTED —** Under a few thousand pounds pipe load and with only lower slip segments engaged, self-energizing resilient seal effects pressure-tight packoff. Note only slight deflection in pipe.



● **MAXIMUM PIPE LOAD — MINIMUM DEFLECTION —** Higher loads increase compression in packing and thereby cause upper slip segments to engage pipe. Thereafter, increases in casing load are distributed to all slip segments. The yield strength of the pipe is not exceeded at joint strength. Pressure loads are carried directly to the seat in the casing head.

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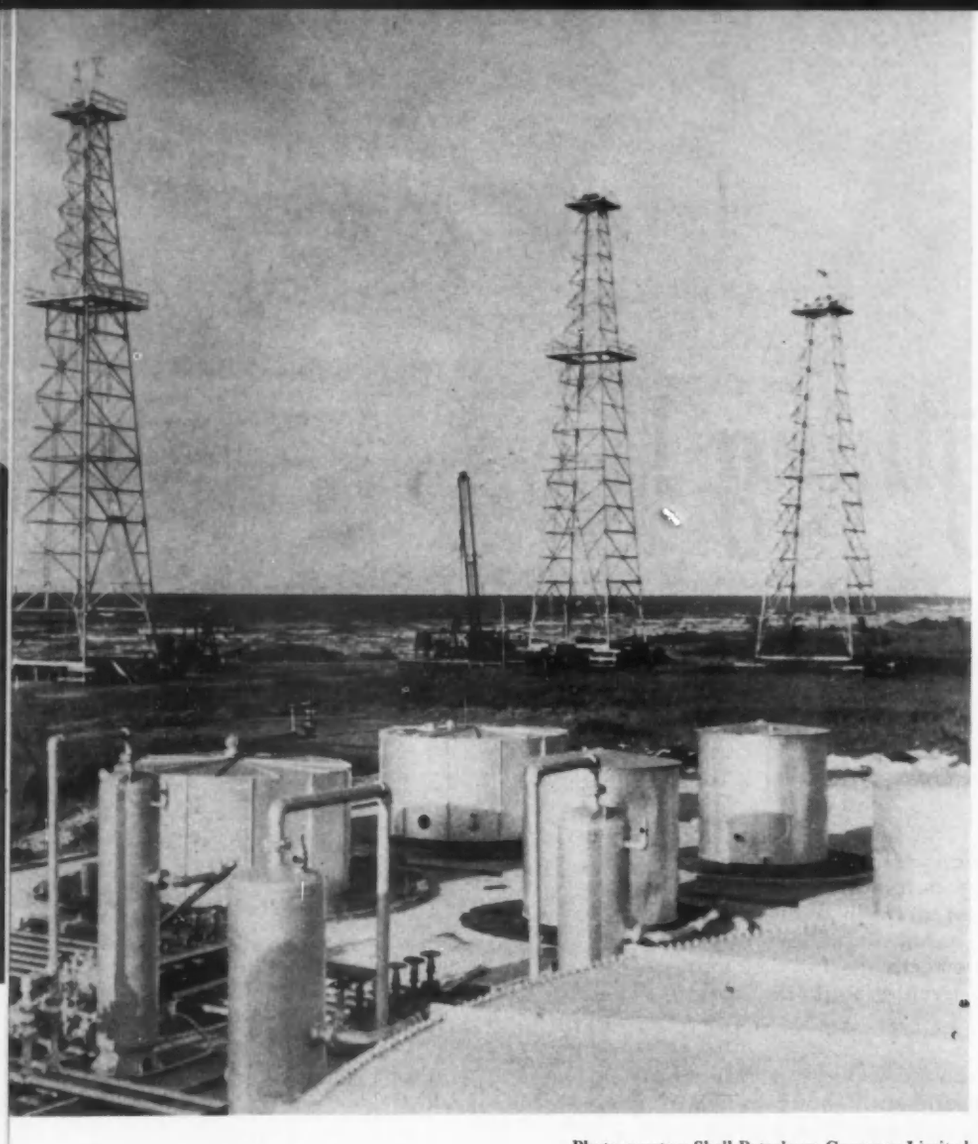

Photo courtesy Shell Petroleum Company Limited

Seashore wells of Seria field, Brunei, showing a block station in foreground which receives the crude oil. From Seria, oil goes to Lutong refinery in Sarawak for processing.

Indonesia and British Borneo

Companies coax steadily increasing production from area.

PRODUCTION IN INDONESIA and British Borneo increased steadily during 1955 as the efforts by the three private companies operating in the region to repair, develop and extend fields damaged during World War II continued to bear fruit. Only in Western New Guinea was there a decline in crude production, among the archipelago's many producing localities.

Total crude production in Indonesia by Royal Dutch Shell, Standard Vacuum Oil Company, and Caltex Pacific Petroleum Mij., was 85,920,511 barrels, or 235,372 barrels per day. This crude yield was 7 percent above 1954's total Indonesia figure of 80,300,000. Royal Dutch Shell, producing 39,004,840 barrels, or 106,863 barrels of crude per day from Indonesian fields, continued active development drilling in ten of its 21 oil fields currently on production.

Shell's production represented 45 percent of the Indonesian total. Standard-Vacuum Oil Company produced 24,542,747 barrels, or 67,240 barrels per day, from Indonesian fields, and Caltex Pacific Petroleum Mij gaged 22,372,924 barrels during 1955, or 61,156 barrels per day.

Standard-Vacuum Oil Company's 1955 Indonesian crude production was mainly from South Sumatra fields. The Talang Akar-Pendopo area yielded 15,297,625 barrels, 62.5 percent of the Stanvac Indonesian total. Benakat field yielded 5,749,774 barrels of crude in 1955, with Djirak and Kruh, and Radja Block, and the Central Sumatra areas producing lesser amounts. By the end of the year, Stanvac had 682 oil wells and 91 gas-condensate wells, capable of production in Indonesia.

The company drilled 46 producers and 4 dry holes in 1955, for a total of 50. Two wells were drilling at the year's end. Total footage drilled in 1955 by Stanvac was 107,000 feet, all in Sumatra.

For 1956, Stanvac had scheduled 43 development wells and 9 wildcats in Indonesia, so that drilling should increase slightly—by about 4 percent—during 1956.

See Table 1 for 1955 activity of Caltex Pacific Petroleum Mij, a post-World War II entrant into the Indonesia production picture.

Caltex reported that as of the end of 1955, 68 producing oil wells were shut in and one well was drilling.

Drilling footage in 1954 in Indonesia was 511,800, so 1955 drilling represented a 13.6 percent decrease from the previous year.

Some activity has been carried out by the Indonesian Government in North Sumatra. Royal Dutch Shell's North Sumatra concession, including Perlak, Gebang, Telaga Said Sarat, and several other fields ranging in

TABLE 1

FIELD	Crude Production 1955 (In Barrels)	Crude Production Daily 1955 (In Barrels)	Total Indonesian Crude Producing Wells End of 1955	FIELD WELLS COMPLETED IN 1955 AT MINAS and DURI FIELDS				Footage Drilled During 1955	Wildcats Drilled During 1955
				Oil	Gas	Dry	Total		
Minas	22,361,384	61,300	95	24	0	1	25	67,867	1*
Duri	8,180	22	n.a.	0	0	0	0	0	0
Pungut	2,180	6	n.a.	0	0	0	0	0	0
Kotabatek	1,180	3	n.a.	0	0	0	0	0	0
Total	22,372,924	61,331	95**	24	0	1	25	67,867	1

* Bekasap 2, a producing oil well.
** Includes producing wells in all four fields.

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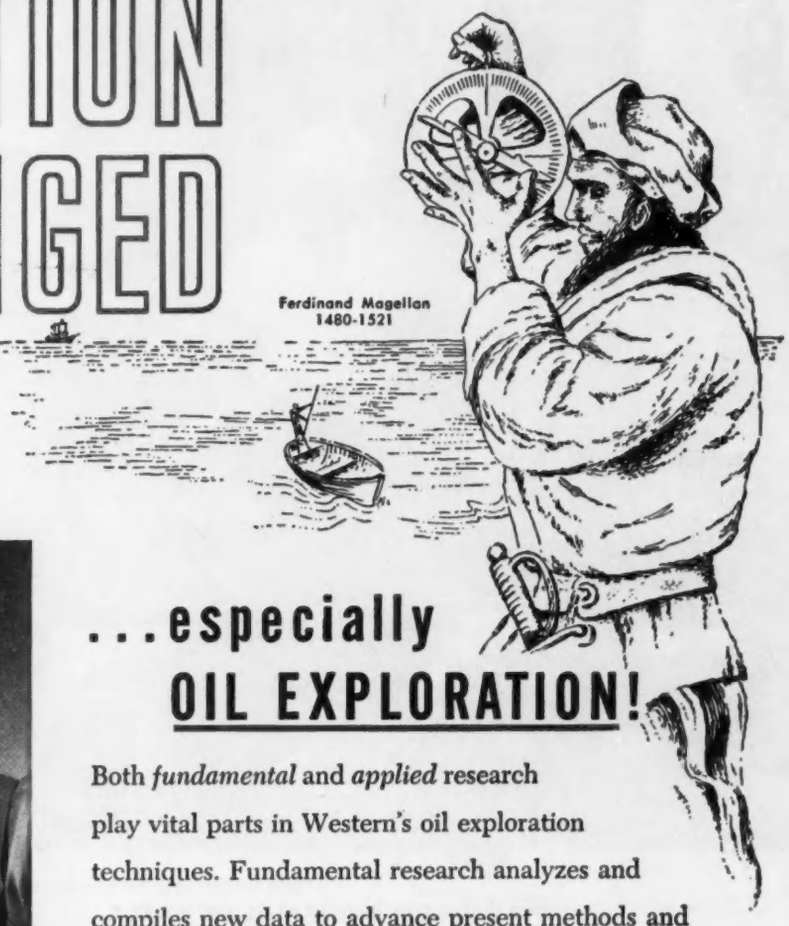

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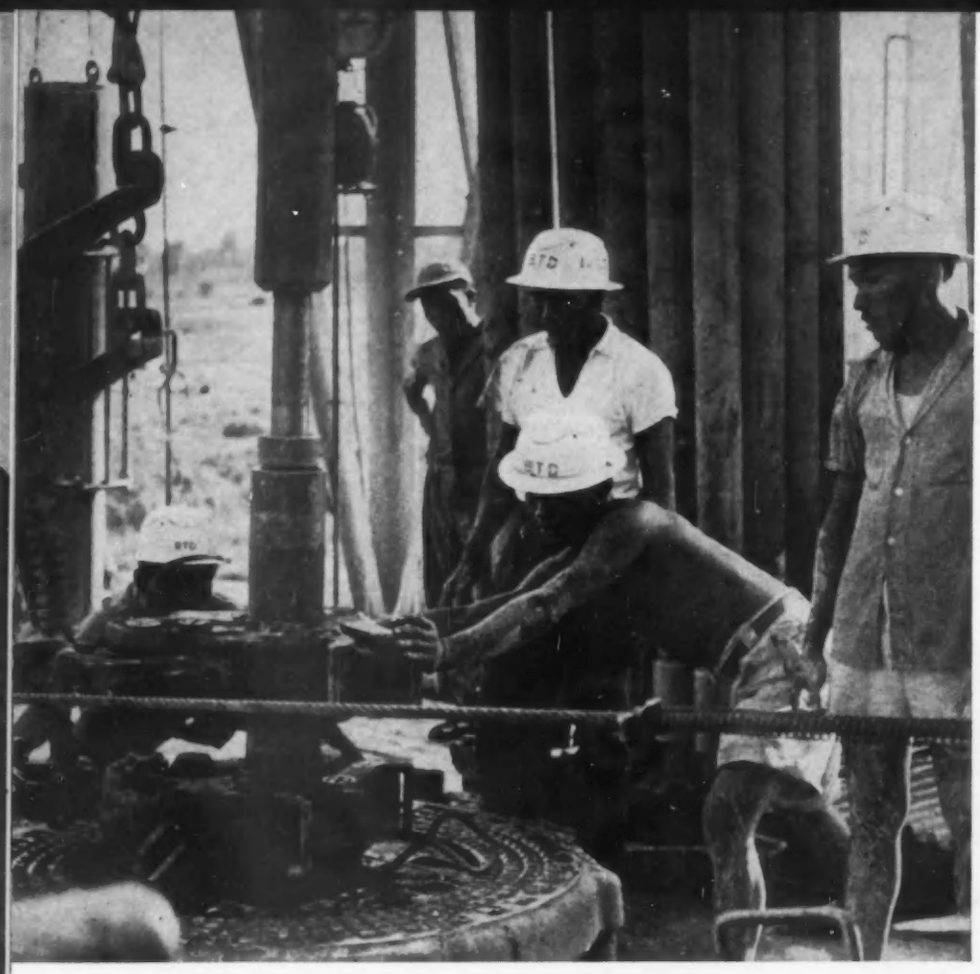

Photo courtesy Shell Petroleum Company Limited

Indonesian drilling crew in action on rig near Surabaya.

discovery date from 1893 to 1937, never has been returned. With proper repairs, maintenance and development drilling, the fields are capable of producing a total of about 30,000 barrels of oil daily. Standard-Vacuum also had a pre-World War II concession in Sumatra, currently in the same suspended status.

The Indonesian Government has formed its own oil bureau to administer production from Shell's former holdings in North Sumatra, damaged by both sides during World War II hostilities. Formerly, the output was distributed locally by the Indonesian government, but now two small tankers are in service, plying the coastal areas to distribute products.

An official government report issued Feb. 13, 1956, said that production had reached 30,000 tons monthly, or about 7000 barrels daily. Depth of the pays ranges from 210 to 4150 feet in North Sumatra, all in Miocene beds with the exception of one Pliocene field. The oil gravity range is from 48.5 to 64.5, all paraffin base and of excellent quality. Undoubtedly some workover activity has been carried out by the government, but it was considered doubtful that any drilling had been done.

Pipe Line Activity in Indonesia. Standard-Vacuum Oil Company has a unique pipe line under construction in Sumatra. When completed in 1958, the 88-mile, 8-inch crude line will open Lirik field in Central Sumatra to full production, estimated at 20,000 to 32,000 barrels daily. Lirik crude has a high component yield from cracking and is low in sulfur, but exceeds 20 percent in paraffin content and has a pour-point of 105.

As a result, all lead lines, tanks, and even the upper 500 feet of tubing in each producing oil well must be maintained at an interior temperature above 105 degrees F., otherwise the crude will solidify. The oil will be heated to 153 degrees F at the pump station, and will be reheated to this temperature in each of four heater-pump stations spaced at 18-mile intervals between Lirik and the Buatan terminal on the Siak River. From Buatan, the oil will be transported by special heater coil lined tankers to Stanvac's Sungei Gerong refinery.

TABLE 2

Drilling Activities in Indonesia During 1955

COMPANY	Number of Wells Drilled	Number of Wells Drilling at End of 1955	Total Footage in 1955
Royal Dutch Shell	57	8	266,863
Standard-Vacuum Oil Co.	50	2	107,000
Caltex Pacific Petroleum Mij.	26	1	67,867
Totals	133	11	441,730

Refineries. Caltex Pacific Petroleum Mij exports its Indonesian crude production, but Royal Dutch Shell and Stanvac have refineries in Indonesia.

Royal Dutch Shell's refineries at Balik Papan, Borneo; Pladju, Sumatra; and Tjepu and Wonokromo, Java, reported a total daily runs-to-stills figure of 159,500 barrels at year's end. That was slightly in excess of designed crude-charging capacity of 158,800 barrels.

Standard-Vacuum's plant at Sungei Gerung, Sumatra, was accounting for a daily intake of 62,844 barrels. Its capacity is 65,000 barrels daily. Thus, with total capacity of 223,800 barrels daily, these Indonesian refineries were operating with a total throughput rate of 222,344 barrels daily at year's end.

Royal Dutch Shell was producing, of course, at its approximate limit. Shell was running about 50 percent more crude through Indonesian refineries than it was producing in the country. Stanvac was running slightly less crude through its Sungei Gerung refinery at year's end than it produces in Sumatra.

British Borneo. Oil activity in northwest Borneo, politically separated from Kalimantan, the Indonesian (and far larger) portion, is confined to Sarawak and Brunei. All operations are carried on by members of the Royal Dutch Shell group.

Production. All production, other than a very recent wildcat discovery, comes from the Seria field, in the State of Brunei, and the nearby Miri field in Sarawak. In 1955, a total of 39,351,213 barrels of oil was produced in British Borneo, or an average of 107,812 barrels per day. The lion's share of this came from Seria field, where rehabilitation of the vast damage done by both sides in World

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War II had reached virtual completion. Seria produced 38,879,361 barrels, o. 106,520 barrels a day, in 1955. Miri's production was 471,842 barrels, or 1293 barrels daily for the year.

The operating company at Seria, British Malayan Petroleum Company, Ltd., completed 34 wells during the year—all successful oil wells. A total of 209,861 feet of hole was drilled, for an average hole depth of 6170 feet. Pay zones are all in Tertiary sands ranging from 1300 to 7300 feet in depth. The crude is of mixed base, from 19 to 38 gravity. Production was steadily rising. It was 107,784 barrels daily during June, 1955, and 112,822 barrels a day in December.

At Miri, Sarawak Oilfields, Ltd., did no drilling, and the situation remained essentially status quo.

Production in British Borneo increased by 7.8 percent in 1955 over 1954, and drilling footage increased by the same percentage.

An important wildcat discovery was made during the year by British Malayan Petroleum Company, Ltd., at Jerudong, in Brunei, midway between Tutong and Brunei town. Oil was found at 3500 feet, the first discovery in British Borneo since the end of World War II.

Pipe Line and Refinery Activity. During 1955, a 2000 barrels daily gas-processing plant was put into operation at Seria, and a 4-inch pipe line carries the gasoline to the Lutong refinery, 40 miles away, in Sarawak, for further processing.

Netherlands New Guinea. Production from the three oil fields in West New Guinea, currently the subject of a territorial sovereignty dispute between two claimants, The Netherlands and Indonesian governments, decreased in 1955. Production in 1954 had soared to 4,370,000 barrels, more than twice the output in 1953. But in 1955 the yield dropped abruptly to 3,418,090 barrels, or 9365 barrels per day.

Klamono field produced 1,741,360 barrels, about 4770 barrels daily; Mogoi field yielded 1,426,730 barrels or 3910 barrels daily; and Wasian field produced 250,000 barrels, or 685 barrels daily.

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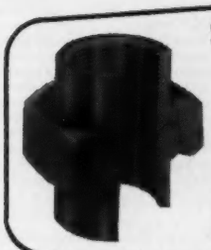

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of depth at Klamono, from 2950 to 3370 feet at Wasian, and from 1050 to 1870 feet at Mogoi. The Miocene reefs found productive so far appear to have an oil column only at the crest, and reserves are much smaller than had been hoped originally.

At the end of 1955, Klamono field had 20 producers, Wasian, 7, and Mogoi, 24. A total of 9901 feet of hole was drilled at Wasian, resulting in two oil wells and one dry hole, while Mogoi field had one oil well completed at 1532 feet. In all, 52,133 feet of hole was reported, of which 40,700 feet was devoted to exploratory drilling.

The operating company in Western New Guinea is Nederlandsche New Guinea Petroleum Mij (NNGPM), in which Royal Dutch Shell and Standard Vacuum Oil Company each own 40 percent interests. Caltex has the other 20 percent. There were two bright spots on the 1955 exploration picture. Two successful wildcats were drilled at Vogelkop, where two oil wells, Seleh 44 and 48, were completed at about 4000 feet and shut in.

Drilling and Producing Activities in Indonesia in 1955, by Field

Name of Company	Field	Location	Year Discovered	Footage Drilled in 1955	Total Wells Completed in 1955	Oil	Gas	Dry	Wells Drilling 12-31-55	Number Wells Producing 12-31-55	Total 1955 Crude Production in Barrels	Average Production 1955 Barrels Daily	Crude Production, Barrels Daily December, 1955
N. V. De BPM (Shell)	Kawengan	Java	1926	6,093	2	1	0	1	0	82	4,076,170	11,167	9,380
N. V. De BPM (Shell)	Tandjung	Kalimantan (Indonesian Borneo)	1938	801	0	0	0	0	1	0*	30,870	84	10
N. V. De BPM (Shell)	Tarakan	Kalimantan	1906	135†	0	0	0	0	0	419	1,626,690	4,462	4,460
N. V. De BPM (Shell)	Sanga Sanga	Kalimantan	1897	0	0	0	0	0	0	89‡	1,165,290	3,200	3,210
N. V. De BPM (Shell)	Anggana-Muara	Kalimantan	1902	0	0	0	0	0	0	86‡	717,460	1,925	1,970
N. V. De BPM (Shell)	Sembodja	Kalimantan	1910	0	0	0	0	0	0	48	334,150	912	890
N. V. De BPM (Shell)	Balik Papan	Kalimantan	1903	0	0	0	0	0	0	?	2,040	6	.....
N. V. De BPM (Shell)	Babat	South Sumatra	1901	0	0	0	0	0	0	18	13,010	36	40
N. V. De BPM (Shell)	Mangunjaja	South Sumatra	1935	0	0	0	0	0	0	53	722,050	1,976	2,000
N. V. De BPM (Shell)	Prabululih, West	South Sumatra	1953	22,569	4	3	1	0	0	7	1,185,850	3,258	3,780
N. V. De BPM (Shell)	Badjubang	South Sumatra	1927	0	0	0	0	0	0	25	941,060	2,580	2,430
N. V. De BPM (Shell)	Kenali Asam	South Sumatra	1931	21,962	7	7	0	0	1	91	5,326,630	14,580	13,670
N. V. De BPM (Shell)	Tempino	South Sumatra	1931	16,722	6	6	0	0	1	96	2,757,100	7,560	7,370
N. V. De BPM (Shell)	Meruo Senami	South Sumatra	1938	9,012	1	0	0	1	0	2	3,600	10	10
N. V. De BPM (Shell)	Limau	South Sumatra	1928	80,908	17	15	0	2	3	40	5,718,290	15,680	16,310
N. V. De BPM (Shell)	Talang Djimar	South Sumatra	1937	27,801	7	7	0	0	1	97	7,638,030	20,900	19,560
N. V. De BPM (Shell)	Gunung Kemala	South Sumatra	1938	51,333	8	6	0	2	1	19	2,157,880	5,910	6,420
N. V. De BPM (Shell)	Tandjung Tiga	South Sumatra	1940	0	0	0	0	0	0	29	1,708,750	4,675	5,850
N. V. De BPM (Shell)	Suban Djerigi	South Sumatra	1905	0	0	0	0	0	0	1	142,550	390	430
N. V. De BPM (Shell)	Sei Taham	South Sumatra	1903	0	0	0	0	0	0	1	13,090	38	60
N. V. N. I. A. M.	Bunju	Kalimantan	1930	29,527	5	5	0	0	0	25	2,724,380	7,480	7,900
		Total.....	.....	266,863	57	50	1	6	8	1203	39,004,940	106,829	105,750

Footnotes: * 23 wells shut in at year's end. Production for local use only. † Deepening old wells. ‡ Includes five gas wells.

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Commercial oil was also reported in a deeper pay in the Wasian field.

Papua. Australasian Petroleum Company, which includes The British Petroleum Company, Ltd., Standard-Vacuum Oil Company, and Australian interests, continued exploratory work in Australian New Guinea which has been pursued for more than 20 years. Three wildcat wells, Omati 1, Omati 2, and Aramia 1, all in the Southeast Territory, were abandoned at depths of about 10,000 feet. Total footage drilled was 31,860.

In February, 1956, the initial really encouraging event of the long exploration effort in Papua occurred. At Kuru, a wildcat found a heavy gas flow at 998 feet and a violent blowout resulted. With the help of Myron Kinley, Houston, Texas, oil well fire fighter, the well was brought under control without a fire occurring. The well was cemented to the surface and a directional hole was drilled to place a column of mud against the high-pressure zone. The area was not being explored for gas, but the gas occurrence may help lead the operators to a crude oil accumulation as exploration progresses.

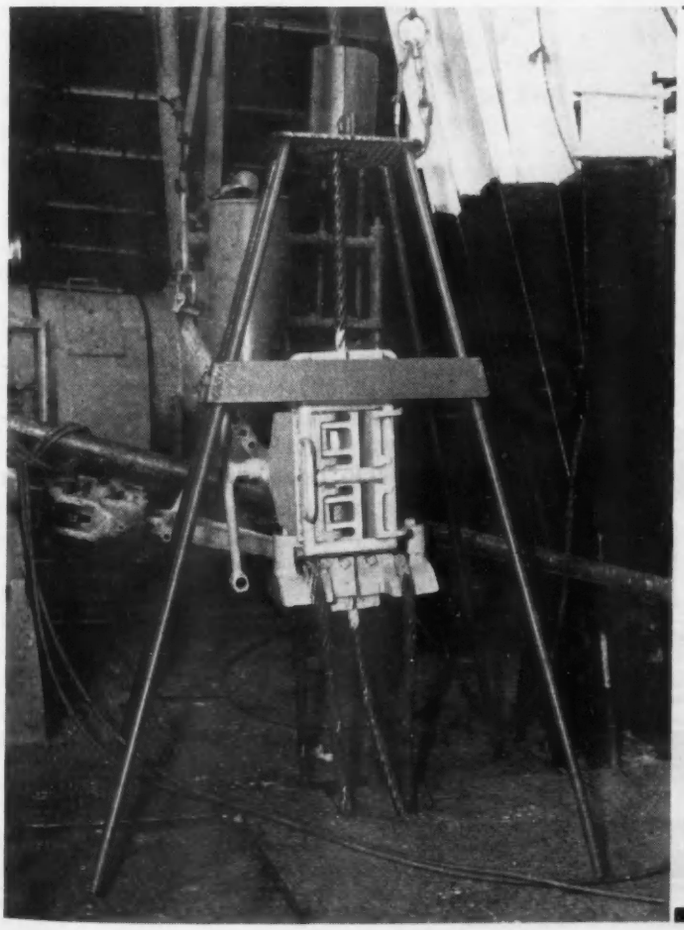
China . . . Communists reportedly set 33 million barrel-a-year goal by 1960. Prospects are good.

AVAILABLE DATA indicate that Communist China is making a strong bid toward becoming an important oil nation. Qualified sources say that crude production on the mainland is at a minimum level of 19,000 barrels per day (6.84 million barrels annually) and may be as high as 36,000 barrels daily (13.2 million barrels annually). China's goal for 1960 is said to be 90,000 barrels daily, or 33 million barrels a year.

There is little doubt that potentialities for fulfilling this goal exist in Red China. The vastness of the country, the thick sedimentary sections, often coupled with spectacular geological structure, indicate that prospects are good for development of large oil and gas reserves. An oil field, discovered in 1953 in Szechwan province, reportedly has since been developed as a major reserve. Reports of discoveries even farther west, in Sikiang and Chinghai provinces, where ground elevations are commonly above 12,000 feet, indicate that the Chinese are vigorously exploring the hinterlands for oil. The remoteness of the lands, and lack of good roads, technical personnel, adequate equipment and good communications are the only apparent hindrances to China's oil expansion.

Red China is one of the most difficult countries in the world to acquire accurate oil data from, since only the Chinese and some Russian, Rumanian, and other Iron Curtain technical persons have direct access to the Chinese oil business. There is almost no diplomatic liaison between Red China and the Free World through which technical oil data might be exchanged.

However, it is the distinct impression of many observers that Red China is taking to Communism better than any other Red nation, Russia in-



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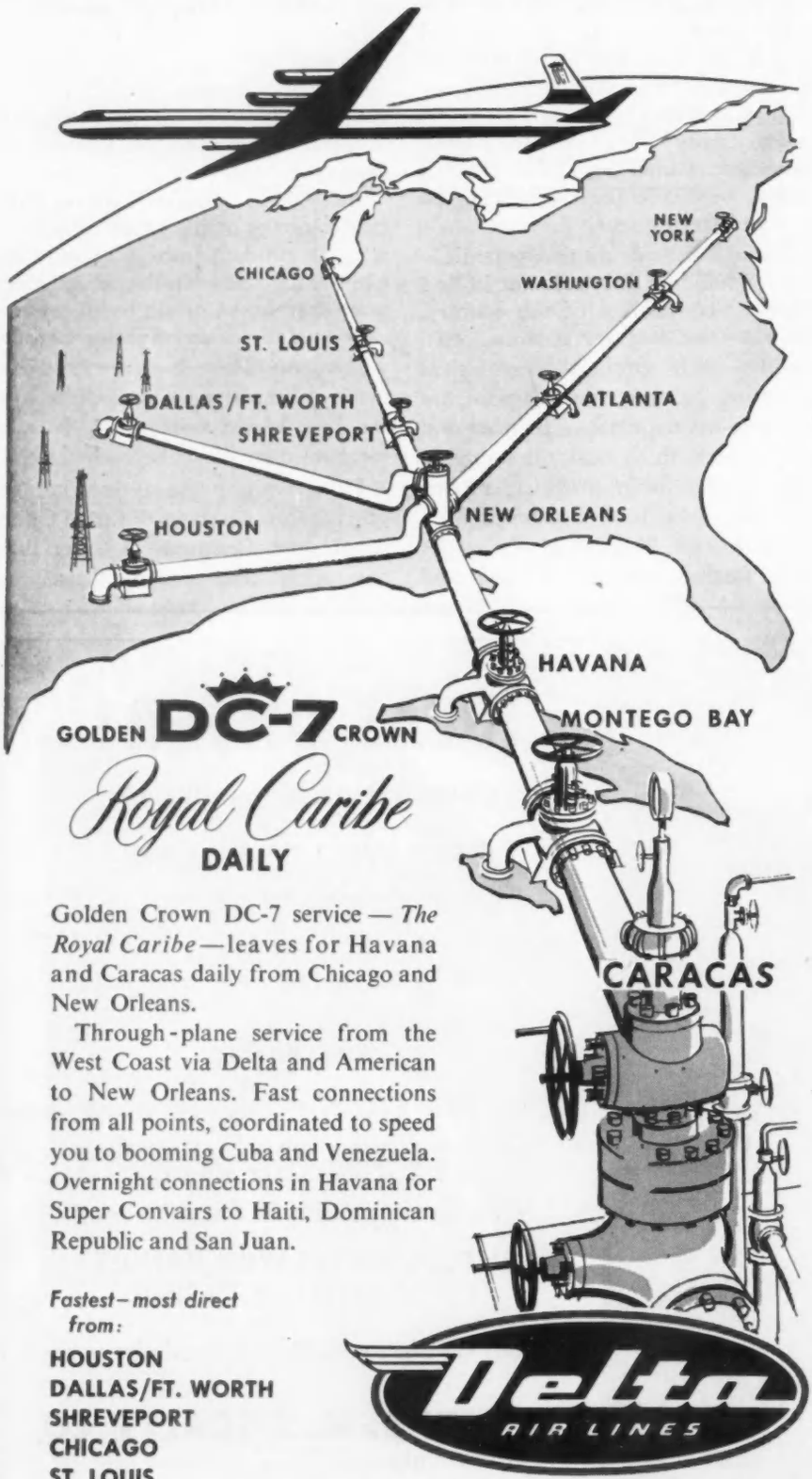

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cluded. The ruthless methods used by the Peking regime to organize China toward achievement of the state's ends appear to be successful in harnessing traditional Chinese industriousness into a concerted effort to catch up with the rest of the world, after so many centuries of feudal rule and impotent national regimes.

China's vast coal and iron ore reserves, centered in Manchuria, afford the potential of China's pulling its oil industry up by the nation's own bootstraps. Oil field equipment and tubular goods reportedly are being manufactured in Manchuria steel centers.

Pakistan . . . Wildcat spudded in as search continues.

DESPITE THE failure to prove any new oil fields, 1955 and the first half of 1956 were bright periods exploration-wise for Pakistan. Most of East Pakistan is covered by concessions held by Pakistan Petroleum Ltd., Standard-Vacuum Oil Company and others. Stanvac conducted gravity surveys, following up previous magnetometer leads in the Bengal basin in preparation for sending in seismic field parties to detail the prospects.

In West Pakistan, Stanvac, after aero-magnetic and seismic surveys, spudded in its Digh wildcat 130 miles east-northeast of Karachi, near Jhudo. Southeastern Asia Drilling Company was named contractor. The 140-foot drilling rig is capable of drilling to the projected 10,000 feet. Like Stanvac, Nelson Bunker Hunt and Shell Company of Pakistan hold concessions of 10,000 square miles or more in West Pakistan with plans for exploratory drilling.

The concessions call for 75 percent of the costs to be borne by the operator and 25 percent by the government, with the value of any production to be shared according to the same ratio. Any profits are to be split 50-50 between the company and the government.

This continuing and expanding exploration program, together with the recent report that Pakistan Petroleum had found oil about 18 miles from Chakwal Tehsil in the Jhelum district at 12,000 feet, was of extreme importance of the country since do-

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mestic crude production supplies only 20 percent of its demand.

Of particular importance to Pakistan's economy was the completion in April, 1955, of the 350-mile, 16-inch, $150 million natural gas pipe line from Sui gas field to Karachi. Built by the Sui Gas Transmission Ltd., the pipe line was completed in 168 days.

Initial gas sales were made to a Karachi textile plant and other industrial users Aug. 30, 1955.

Sui gas field is one of the world's largest. Preliminary reserve estimates indicate that more than 100 Mmcf. could be delivered from the field daily for 60 years. Additional pipe lines were planned to Lahore and

Well drilling of Southeastern Asia Drilling Company in Pakistan (West) on June 21, 1956.

Multan and to other neighboring cities in the Punjab. Sui gas production, all from six wells, totaled 1,323,316 Mcf. from July, 1955, through year's end. Dhulian field, in the Potwar area, produced 52,398 Mcf. of casinghead gas.

A 60-mile line was completed from the Dhulian field to Attock Oil Company's Rawalpindi refinery, which has operated on natural gas since Dec. 23, 1955. The line was completed in three and a half months.

Production. Pakistan, again in 1955, saw its crude production climb though it was restricted to the old Potwar area of the Punjab in northwestern Pakistan. Output rose to 2,068,000 barrels, or 5670 barrels a day, and represented a 6 percent increase from 1954. That year production totaled 1,948,000 barrels, or an average of 5336 barrels a day.

Attock Oil Company reported production of 729,284 barrels in 1955 from Dhulian field, 611,347 barrels from Balkassar, and minor production from the old Khaur field (discovered in 1915) and Joya Mair. Sixty-six wells were still producing at Khaur and 18 at Dhulian at year's end.

Pakistan Petroleum Ltd. reported a crude yield of 418,130 barrels—1145 barrels a day—from its Balkassar oil field during 1955.

Cumulative crude output in Pakistan at year's end amounted to 21,800,000 barrels.

Refining. The Rawalpindi refinery's average throughput during 1955 was 4807 barrels daily, representing its approximate capacity.

Other Developments. Further developments in Pakistan's oil industry included:

- A strong show of gas at Uch, near Sui, in Baluchistan at 11,000 feet reported by Pakistan Petroleum Ltd.
- An oil show reported by Attock Oil at its Karsal test in West Pakistan at a depth of 12,021 feet on April, 1956.
- Scheduling of seven wildcats to be drilled in West Pakistan during the second half of 1956.

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Philippines . . . Proposed law encourages exploration. Stanvac leads intensified program.

THE PHILIPPINES in 1956 expected to experience an intensified oil exploration program in view of projected operations of the oil companies currently holding exploration concessions.

Standard Vacuum Oil Company, which supplies a large part of domestic requirements for petroleum products, was expected to improve its existing facilities on a large scale. However, this major development does not include the contemplated expenditures for a proposed refinery project, the building of which was still under consideration at mid-year.

For exploration operations in the Cagayan valley in northern Luzon, Stanvac has earmarked a reported $897,000. The company's concessions in the area total about 959,600 acres. Drilling operations were in the planning stage, and full-scale activities were to begin at the end of the rainy season, such as construction and repair of roads and bridges.

The Texaco Overseas Petroleum Company and the California Asiatic Oil Company, holding joint interest in seven concessions, totaling about 1,233,000 acres, had planned to put into the field one geophysical party and one geologic reconnaissance survey party. No drilling activity was contemplated for 1956.

Acoje Mining Company planned to continue its diamond drilling operations in its southern Cebu concession. Acoje holds seven additional applications covering about 1,275,000 acres in Luzon, Leyte and Mindanao islands. Plans were being made for geological reconnaissance and aerial mapping of these areas as soon as applications have been granted.

San Jose Oil Company, Inc., has applications covering about 2,471,000 acres in central Luzon, Panay island, Cotabato, and Davao basins. Pending final execution of the concession contract, San Jose will conduct an airborne magnetometer survey of the regions. The company already had begun hiring personnel and buying equipment for a field geological party for each of the four areas. The magnetometer survey is scheduled to be followed by gravimetric and seismic surveys.

Last January, Philippine Oil Development Company, Inc., spudded in a test in the Cagayan valley. At almost mid-year, the well had reached 8643 feet, at which time the running of an electric log was being considered. High gas pressures were noted at various levels.

A proposed bill had been introduced in the Congress of the Republic in an effort to amend articles of the Petroleum Act of 1949 (Republic Act No. 387). Major features of the new bill would:

- Assure extension of an exploration concession if the concessionaire has complied with the petroleum act, regulations and terms and conditions of concession contract;
- Allow export of equipment, machinery, instruments, materials, supplies and accessories—imported free of duty for use in concessionaires' operations—to be exported free of tax;
- Provide a system of arbitration; and
- Authorize transfer and assignment of concessions under certain conditions.

Encouraging signs took definite shape during 1955 toward an increasing exploration trend with the grant-

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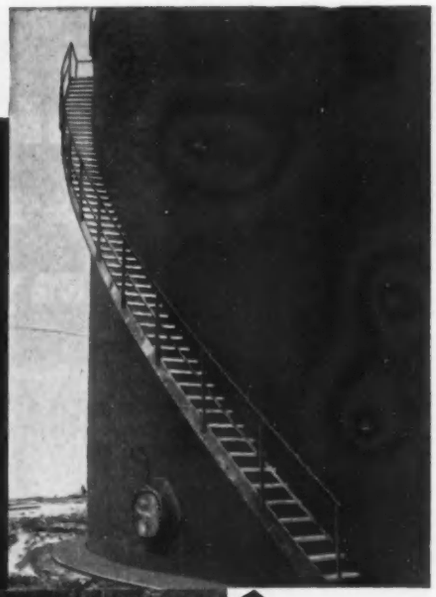

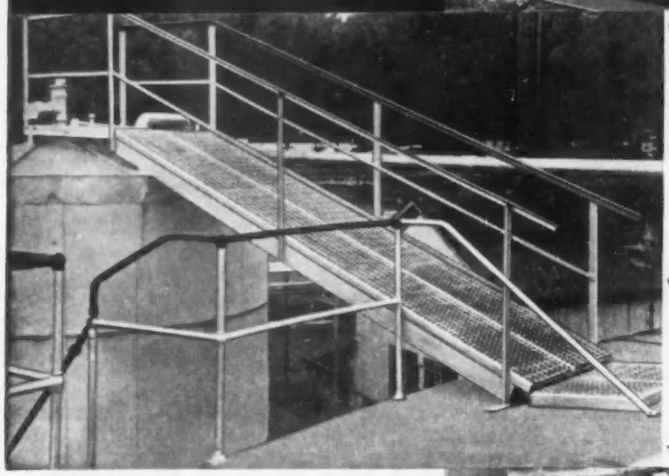

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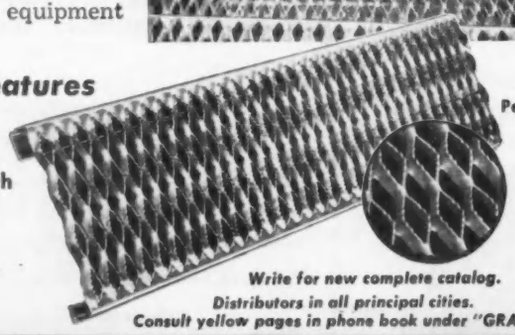

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ing of 3,585,043 acres as follows:

Concessionaire	No. of Concessions	Acres
Standard-Vacuum Oil Co.	8	959,613
Philippine Oil Development Co., Inc.	10	1,258,661
Acoje Mining Co., Inc.	1	133,681
Caltex (Philippines), Inc.	7	1,233,088
Total	26	3,585,043

These grants, in addition to the two concessions previously granted to the Luzon Stevedoring Co., and Philippine Oil covering 237,600 acres, brought under exploration operations during 1955 a total of more than 3,706,500 acres.

Last year, reconnaissance surveys were resumed by field parties of the Philippine Bureau of Mines. The area covered included 247,100 acres in Davao province (Mindanao island)

Petroleum indication in the subprovince of Bontoc.

and about 50,000 acres in Pangasinan province (central Luzon). Five oil seepages were verified in Bontoc, Mt. Province, near the Cagayan valley. Bureau paleontologists conducted stratigraphic studies of sections of northern Davao, central Cebu and central Iloilo.

The increasing interest in Philippine exploration may be traced to the release of the Corby Report (Technical Bulletin No. 21) on a prewar petroleum resources survey; the existence of oil seepages in various parts of the archipelago—said to be the only missing link in the chain of producing islands fringing Southeast Asia; enactment of a liberal oil law in 1949; and improvement of the national economy and a stable Philippine peso.

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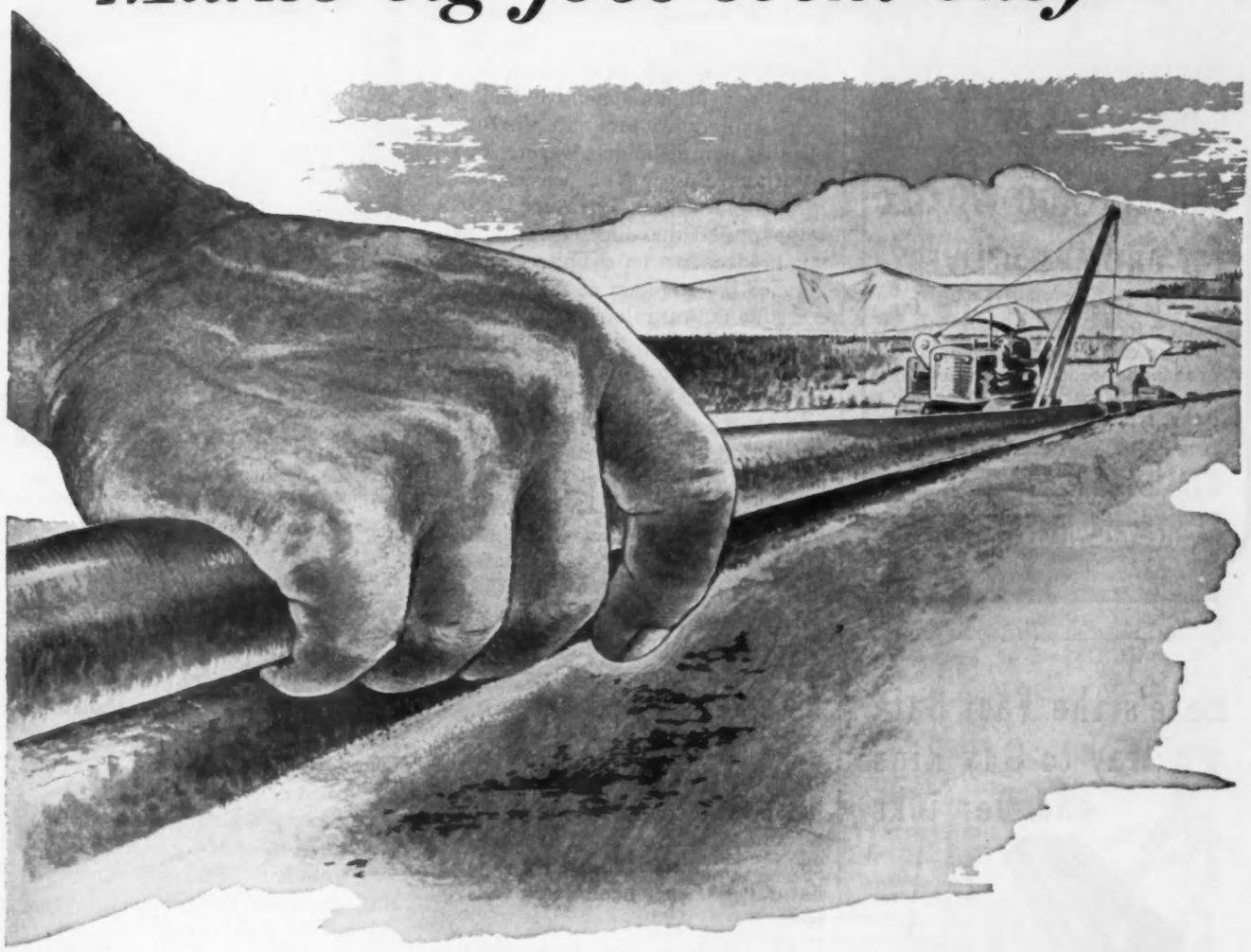

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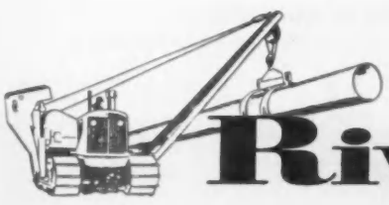

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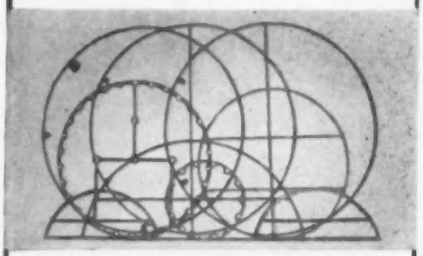

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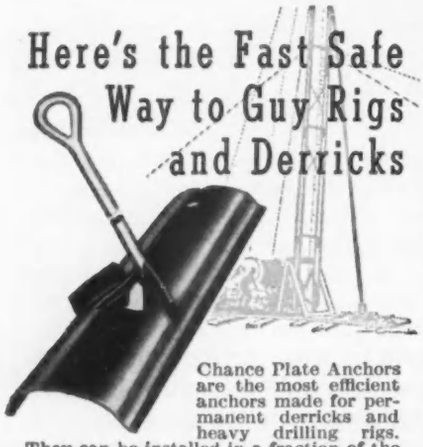

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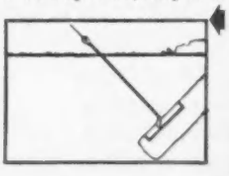

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Australia . . . Exploration continues in West. Oil shows in Victoria reported at 5100 feet.

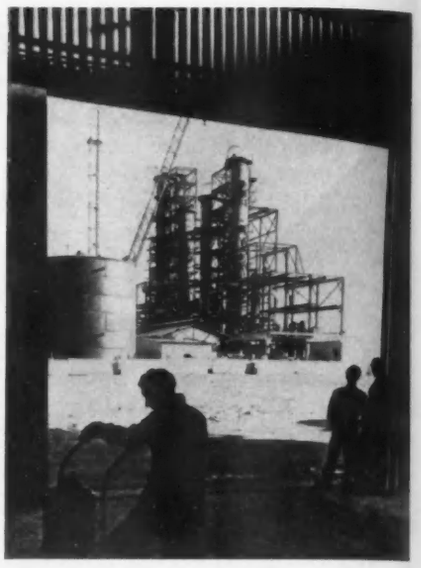
FOLLOWING A YEAR of intensified exploration activities, Australia looked forward in 1956 to a continuing high level of activity. While in Western Australia it appeared likely that West Australian Petroleum Pty. Ltd. would continue with an extensive and detailed exploratory program, the future of other permit holders was not clear. Associated Freney N. L. was expected to continue drilling operations, but it was reported that the remaining permit holders had no definite plans for detailed investigation of their permits.

In South Australia, Santos Limited in 1956 was drilling its No. 1 test at Wilkatana, about 30 miles north of Port Augusta. A depth of 580 feet had been reached at year's end, and traces of light oil were found at 230 feet and between 440 feet and 549 feet. A further showing of heavy crude was discovered at 574 feet in limestone, but the significance of the shows had not been established at mid-1956.

Early in 1956 Woodside (Lakes Entrance) Oil Co. N. L. 2, which was spudded in four miles south of Well 1 in which oil shows were reported at 2576-77 feet and at 4430 feet before the well was suspended, reported that at 1310-1330 feet cuttings were associated with a dark brown oil. Shows of oil also were reported at 1500 feet, 2800 feet and 5120-5129 feet, and natural gas was encountered at 3200 feet.

After drilling through the 800-foot covering of hard Jurassic shales, sandstone was encountered. In the 5120-5129-foot interval, coarse Jurassic sandstone impregnated with oil was reported. That confirmed the 4430-foot show in Woodside 1.

This is the first time that oil has been found in Victoria in sediments older than Tertiary. Samples of the crude were sent to the U. S. for analysis.



Distillation unit seen through doorway of a machine shop at GeeLong Refinery in Australia.

In March, 1956, Woodside 2 was electric logged, cased and cemented to 6110 feet, pending arrival of 2⅞-inch drill pipe. The company expected to drill 1500 feet to 2000 feet deeper. Meanwhile, preparations were begun for a third test 200 yards southwest of No. 2.

Crude production during 1955 amounted to 16,896 barrels. One well was producing, and 152 others were shut in at year's end. Total footage drilled last year amounted to 150,289 feet, resulting in 3 oil wells and 33 dry holes.

Western Australia. During 1955 exploration drilling operations were carried out by two companies. West Australian Petroleum Pty. Ltd. continued operations on prospecting licenses in Cape Range and Rough Range areas in the North West Basin

Drilling and Production in Australia

REGION	1955 Crude Production (Barrels)	No. of Producers	No. of Wells Shut in as of Dec. 31, 1955	Amount of Footage Drilled During 1955 (Feet)	No. of Wells Drilling at Dec. 31, 1955	1955 Field Well Completions			Wildcats Drilled During 1955		
						Oil	Gas	Dry	Oil	Gas	Dry
Western Australia	16,896	1	1	80,303	3	1	..	4	1	..	13
Victoria	....	..	151	10,738	..	..	..	..	1	..	1
Queensland	....	..	...	58,668	..	n.a.	n.a.	n.a.	..	..	15
South Australia	....	..	...	580	1	..	..	..	..	..	..
Total	16,896	1	152	150,289	4	1	..	4	2	..	29

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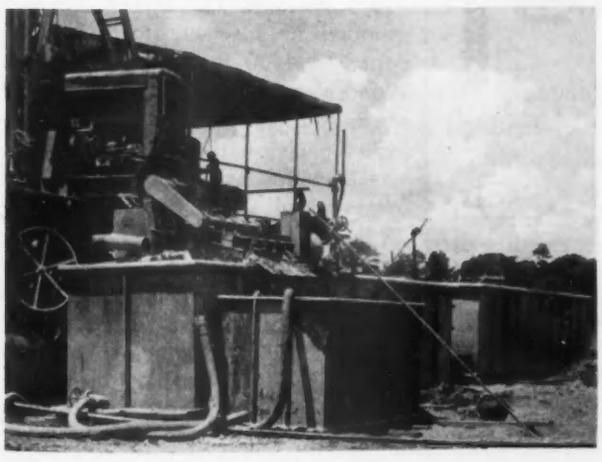

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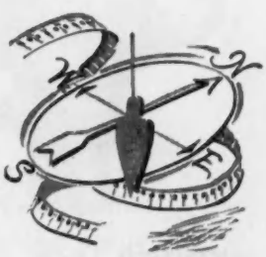

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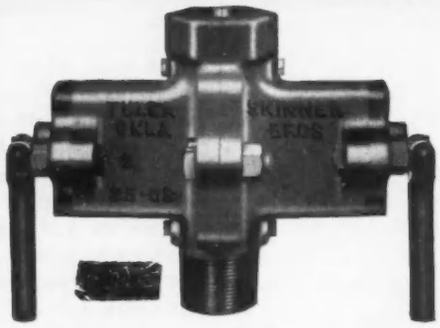

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and at Grant Range in the Fitzroy Basin.

Relatively shallow structure testing wells were drilled in the Giralia, Warroora, Grierson, Cuvier, and Dirk Hartog license areas. A well at Fraser river in Dampier Land was spudded in toward the end of the year.

WAPET drilled 83,031 feet during 1955 in 19 wells, two of which were drilling ahead at year's end.

Associated Freney N. L. completed a deep test well on the Nerrima structure, and began another on the Myroodah anticline. The latter was being drilled ahead at year's end. Total footage drilled by AFNL in the two holes during the year was 14,612 feet.

Victoria. During 1955, prospecting licenses were held in the southeast and southwest sections of the state. Exploration activity was centered at South Gippsland, in southeastern Victoria, where oil previously had been discovered in non-commercial quantities.

Interest in this area has revived, and considerable geological and geophysical work has been carried out by the government and private capital in the past two years. In 1955 two firms holding prospecting licenses drilled at South Gippsland: Frome-Lakes Proprietary Ltd. at Darriman and Woodside (Lakes Entrance) Oil Company N. L. on the Woodside dunes.

Frome-Lakes' Darriman 1 was spudded in July 14, but was abandoned at 4730 feet on September 3. Woodside's well, begun in September at the southwestern end of the Ninety Mile Beach on the Woodside dunes, was suspended in December at 6008 feet, with oil shows reported at 2576-77 feet and at 4430 feet.

At year's end major alterations were made to the Victorian petroleum laws by passage of the Mines (Petroleum) Act of 1955. The principal provision of the new act relates to the issue of an additional search title, known as a petroleum exploration permit.

The holder of a permit who carries out his obligations to the satisfaction of the government has a preferential right to obtain petroleum prospecting licenses in any one or more parts of the area covered by the permit.

A permit may be issued for a maximum of 5000 square miles and a minimum of 1000 square miles, while a petroleum prospecting license has a maximum of 200 square miles. Pur-

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pose of the provision was to encourage large capital in oil exploration.

Queensland. Following the lack of success of wildcat drilling in 1954 and 1955, drilling was suspended in September. At mid-1956 there was no prospect of resumption.

Exploration continued, however, during 1955, and a large area was examined by an aerial magnetometer survey. Survey results, it was understood, were regarded as sufficiently promising for further exploration.

South Australia. While no drilling was carried out during 1955 in three license areas, geological and geophysical studies were made in all four license areas. Results of these studies were not available in mid-1956.

Oil exploration licenses currently held in South Australia follow:

License No.	License Holder	No. of Acres
7/1	Santos Limited	176,650
9/1	Frome Broken Hill Co. Pty., Ltd.	4,600
10/1	Murray Basin Oil Syndicate	14,000
11/1	Australian Oil and Gas Corporation	18,000

New Zealand . . .

Crude yield falls; search quickens.

NEW ZEALAND'S petroleum picture for 1955 was marked by a continuing downturn in crude production, a slight increase in natural gas output and a growing interest in exploration, which was continuing in 1956.

Egmont Oil Wells Limited of New Plymouth still holds the only current Petroleum Mining License in New Zealand. This license covers an area of approximately ten square miles at New Plymouth. During 1955, Egmont Oil produced 5705 barrels of crude and 5,499,720 cubic feet of natural gas from five wells.

That compares with crude yield during the previous year of 6856 barrels and natural gas production of slightly more than a 5 Mmcf. from the same five wells.

Egmont Oil's crude production—the only domestic source in New Zealand—yielded 1069 barrels of gasoline, 137 barrels of distillate, 1249

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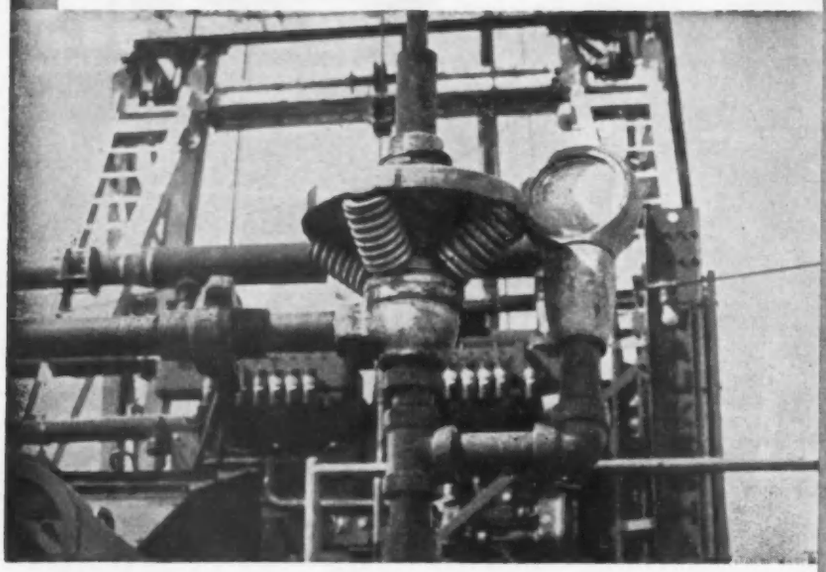

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Currently, the following areas are held under Petroleum Prospecting licenses:

District	Area in Square Miles
Taranaki	6,552
Gisborne, Hawkes Bay, Wairarapa	10,152
Auckland	697
Bay of Plenty	66
Marlborough	135
Canterbury	1,973
Otago	30
Southland	150
Westland	489
Total	19,354

The areas in Taranaki are held by Shell Group D'Arcy Exploration Company, Ltd., and Todd Oil Services Limited. Field exploration work in Taranaki was begun in November, 1955. Two geological parties were active in 1956—one in the northern part of the Taranaki basin, the other in the younger Tertiary formations of Taranaki proper.

A study of aerial photographs and the preparation of photogeological maps are under way while geological studies of a more regional character are being carried out.

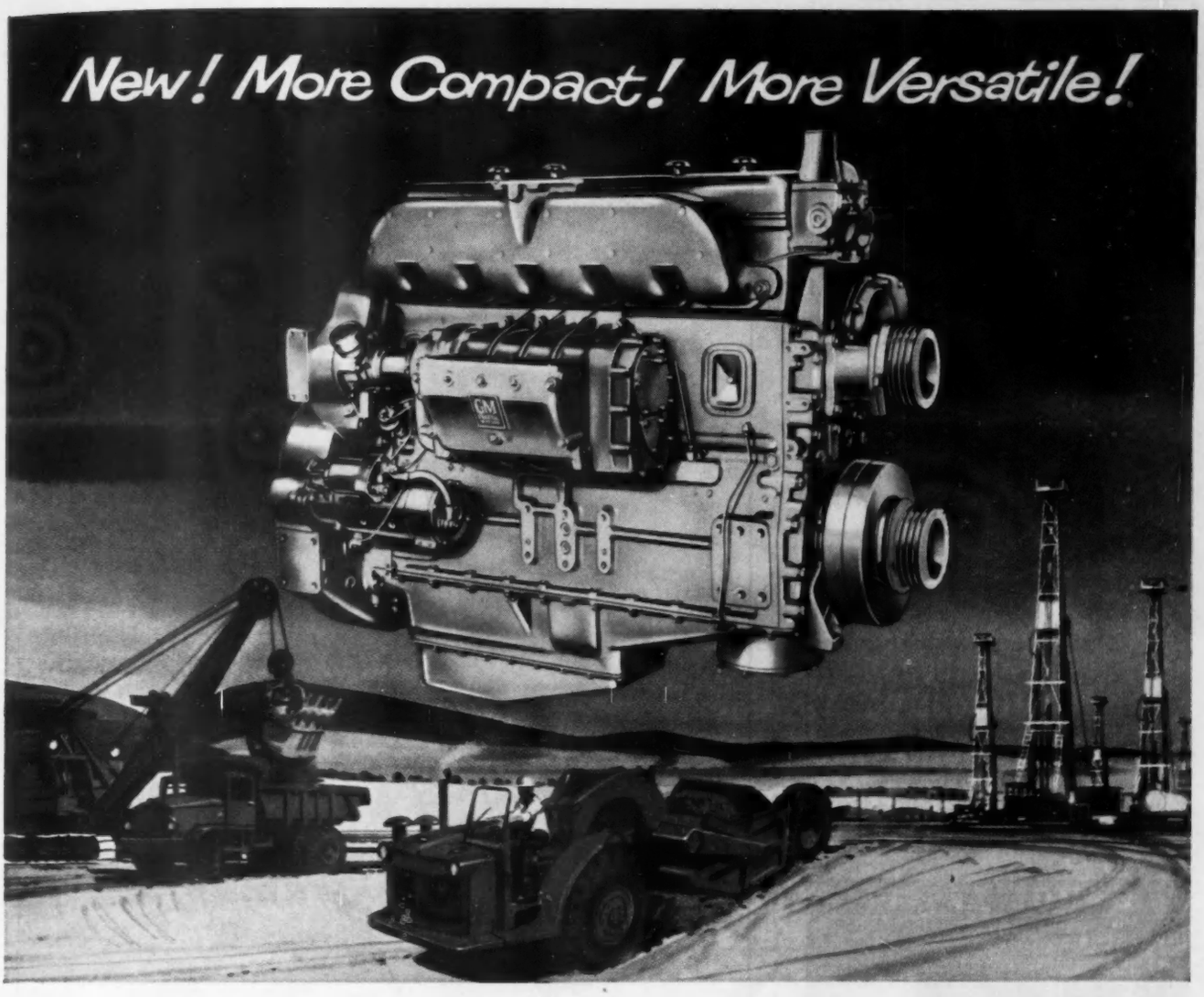
Geophysical activity in New Zealand in connection with oil exploration has been dormant since the early years of World War II. Seismic operations, however, were started up again in the Taranaki area by Shell-D'Arcy and Todd Oil Services early in 1956, and a gravity party and magnetic party are now in the field.

The seismic program calls for a minimum period of three years' field work, but the gravity and magnetic operations, which are aimed mainly at supplementing an existing considerable amount of data, were expected to continue for possibly six months only.

It was not expected that the drilling stage would be reached before mid-1957.

Geological activity also is being conducted in the Gisborne District by Todd Brothers Limited. Increased activity in this district and in Hawkes Bay and Wairarapa was expected in the near future.

Additional exploration efforts included a well which was drilled at Oamaru, in Canterbury District, to almost 3000 feet without result. At the middle of 1956, operations at the well were being held up while the arrival of equipment from overseas was being awaited.



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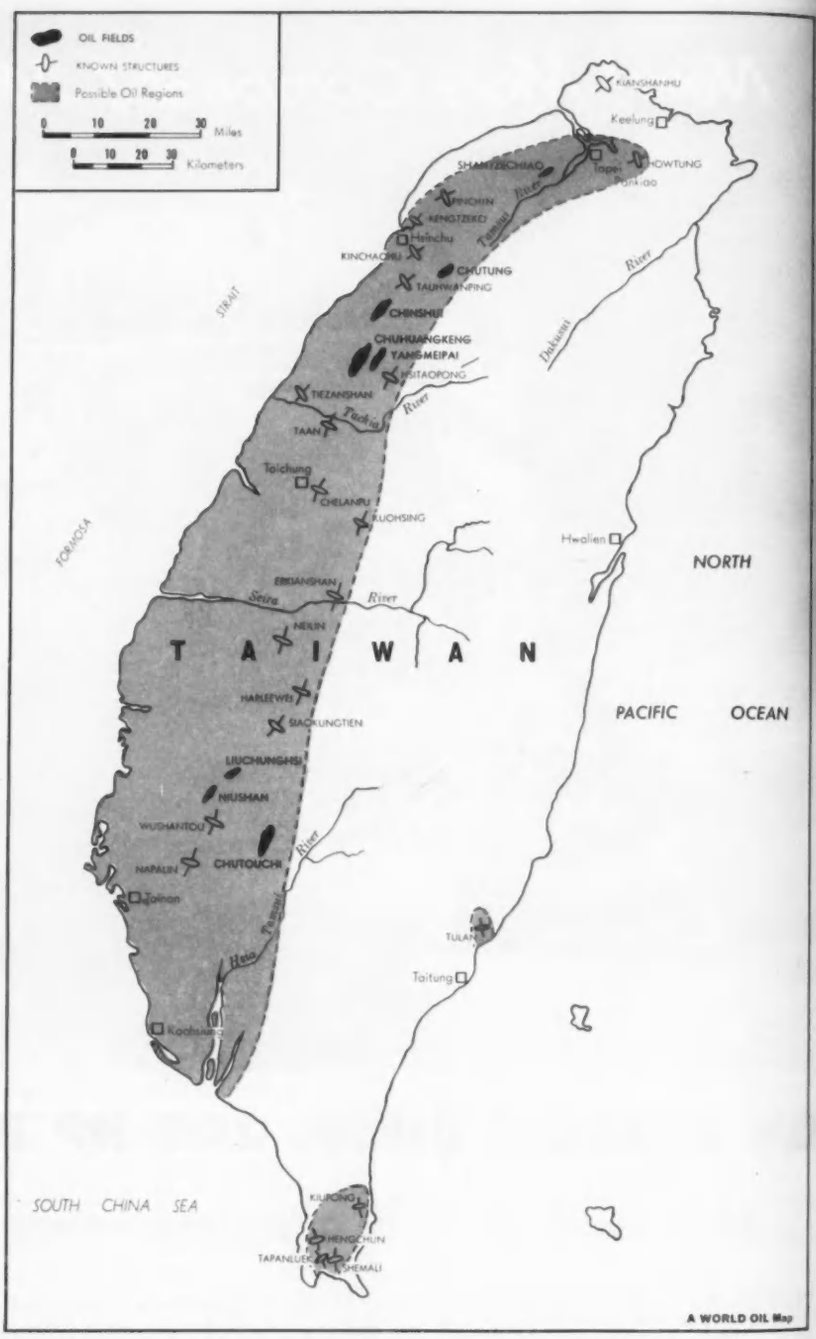
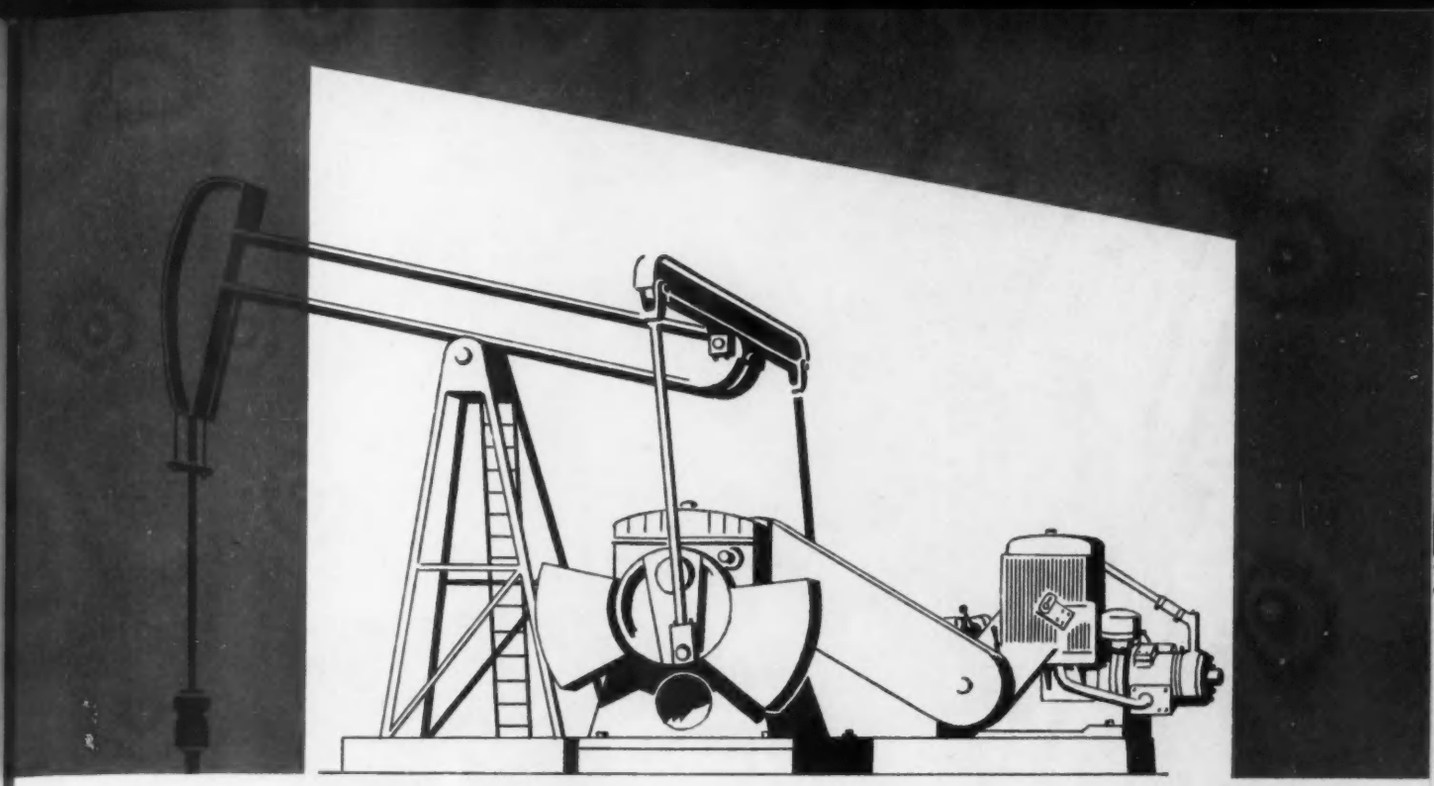


Prospects for oil exploration are promising, but outside interests have been deterred by uncertainty of the long-range future status of this stronghold of the Chinese Nationalists.

Taiwan . . . Government-owned firm to test deeper prospects.

ALTHOUGH the way opened by the passage of a new Foreign Investment Law in 1954 to encourage introduction of foreign capital to aid development of Taiwan's resources and industries, uncertainty of the long-range future status of this island stronghold of the Nationalist Government of Free China has deterred outside interest in the promising prospects for oil exploration. The government-owned Chinese Petroleum Corporation, however, is making every effort within the limits of its financial ability to continue the expanded program of exploration which it began in 1952.

The first small new field discovery early in 1954 was followed in 1955



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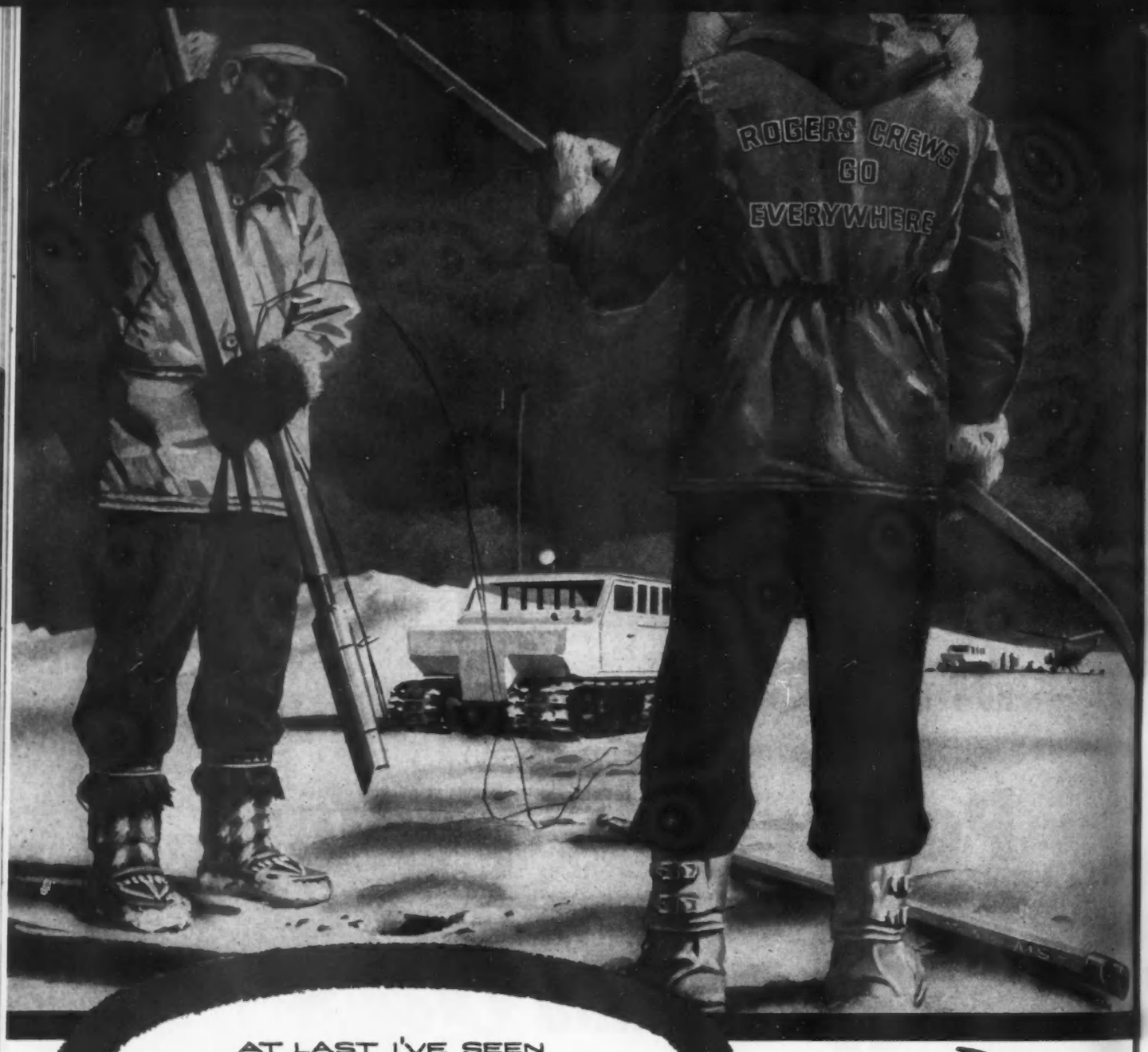

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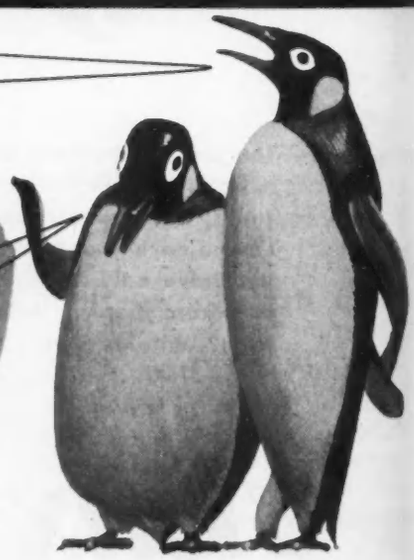

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by the discovery of small crude production on a structure previously untested, and from a horizon lower than any other from which oil indications were previously known.

By mid-1956 four new exploration wells were scheduled to be drilling and others were planned to begin later in the year to test as wide a variety of prospects as possible. These new prospects resulted from the considerably expanded program of geological surveys conducted over the past few years, and from seismic surveys which were begun for the first time in Taiwan early in 1955.

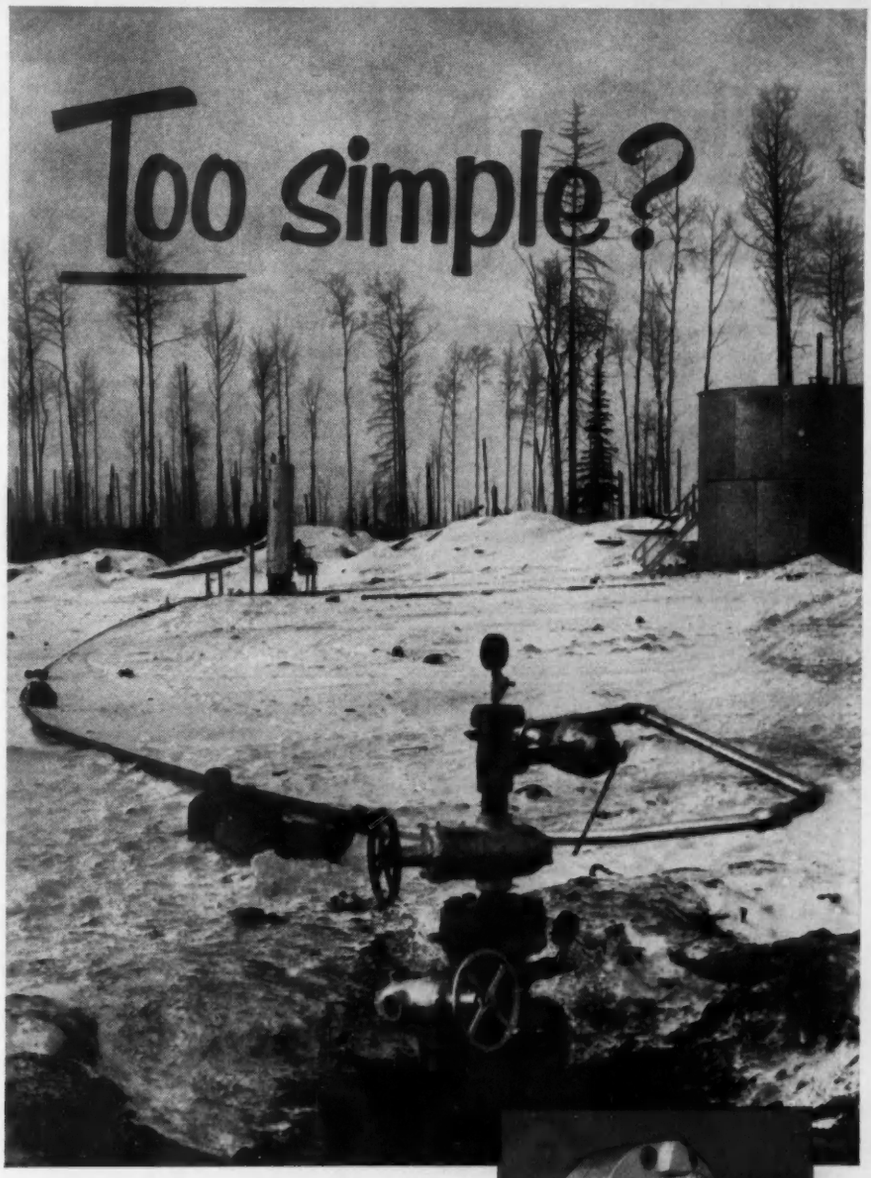
Aid from UN. The United Nations Technical Assistance Administration has supplied the services of a petroleum geologist to the Chinese Government to assist the planning of the exploration program and to guide the operations of the exploration projects. A micropaleontologist also has been provided to establish and supervise a laboratory for systematic biostratigraphic research. A seismologist was expected to be employed to assist with seismic surveys and to train local crews.

The U. S. International Cooperation Administration provided a dollar loan in 1954 for the purchase of drilling equipment and to assist the financing of exploration drilling, but, since this aid was not continued, the 1955 drilling program was affected seriously and only two new wells could be started during the year.

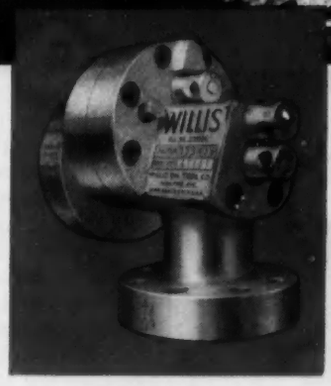
The drilling capacity was strengthened in 1955 by the addition of two shallow diesel-powered rigs obtained with dollar loans provided by ICA in 1954. These rigs are used for wildcats in remote areas where supply of electric power is costly and difficult to obtain and where electric-powered rigs cannot be used conveniently.

Rigs in Operation. Four shallow and medium-depth rigs were in operation at various times during 1955, but the total drilling footage of only 15,782 feet was just 75 percent of the total for the preceding year. The 1955 footage figure included 8997 feet in five wells started in 1954, 816 feet for one deepening project, and 5969 feet in the only two wells spudded in during 1955.

Out of one wildcat, two extensions and one well drilled deeper for a



In the northern frontier of Alberta, the two-valve, uncomplicated Christmas tree of the Union Oil Company well "Red Earth 12-17" loafs along at 200 BPD, reduced from a tested 960 BPD, through a



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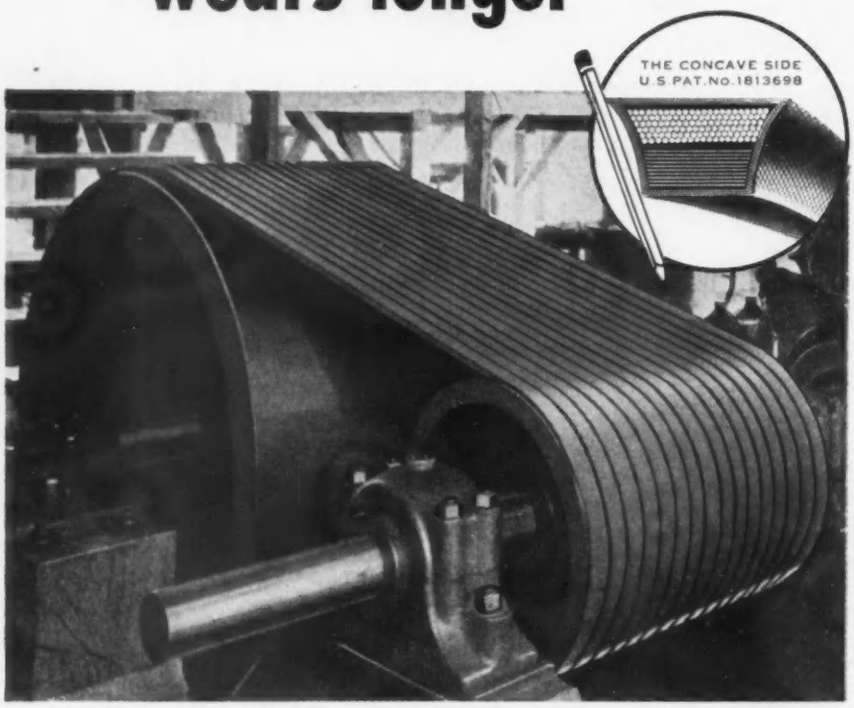
Why a V-Belt with CONCAVE SIDES wears longer



It is easy to demonstrate to yourself why the concave sides (Fig. 1) of the Gates belt greatly lengthen belt life.

Simply bend a Gates belt and feel the sides. Notice how these precisely engineered concave sides *fill out* on the bend and *become straight*. Thus a Gates belt grips the sheave groove evenly (Fig. 1-A) and wear is distributed uniformly across each side of the belt. That means longer belt life; lower costs.

Make the same test with a straight-sided belt (Fig. 2) and see what happens. The sides bulge out on the bend (Fig. 2-A) concentrating the wear at points shown by arrows.

To assure longer wear and keep belt costs down, specify the V-belt with Concave sides—Gates Vulco Rope . . . readily available from nearby distributor stocks. The Gates Rubber Company, Denver, Colorado—*World's Largest Maker of V-Belts.*

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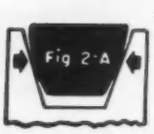

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lower pool test that were completed last year, all but one extension succeeded in finding production of both oil and gas. At year's end two wildcats were drilling, one pool test began drilling on the Shantzechiao structure in March, 1956, and locations were being prepared for drilling in three other areas.

Highlights of exploration drilling completions during 1955 were the discovery of small oil and gas production by a stratigraphic test in the lowest part of the Miocene sequence on the previously untested Shantzechiao structure, and the proving of three deeper productive zones at the Chutauchi South Culmination field, which was discovered early in 1954.

Wildcat test rigging up in rugged terrain of Pakuali structure in northern Taiwan.

Production Down. The drop in drilling footage in 1955 resulted in a decline in crude production during 1955 to 23,557 barrels, only 67 percent of the 1954 amount but still 32 percent higher than the average for 1952-1953. Domestic crude production provides only a small percent of the island's civil requirements. Proved crude reserves as of Jan. 1, 1956, were estimated at 200,000 barrels.

Natural gas production for 1955 was maintained at 98 percent of that for the preceding year, and the rapidly declining production from the old gas field was almost balanced by the new production from Chutauchi. Production still remains at a low level because no development drilling has yet been undertaken to produce the small

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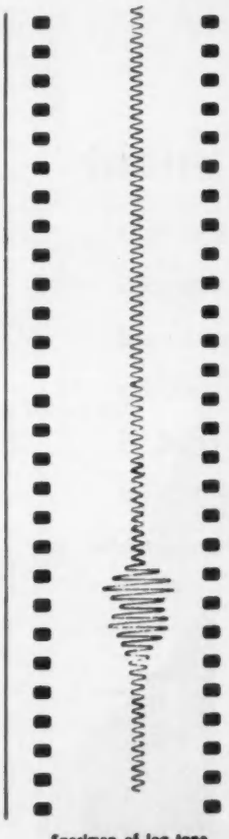
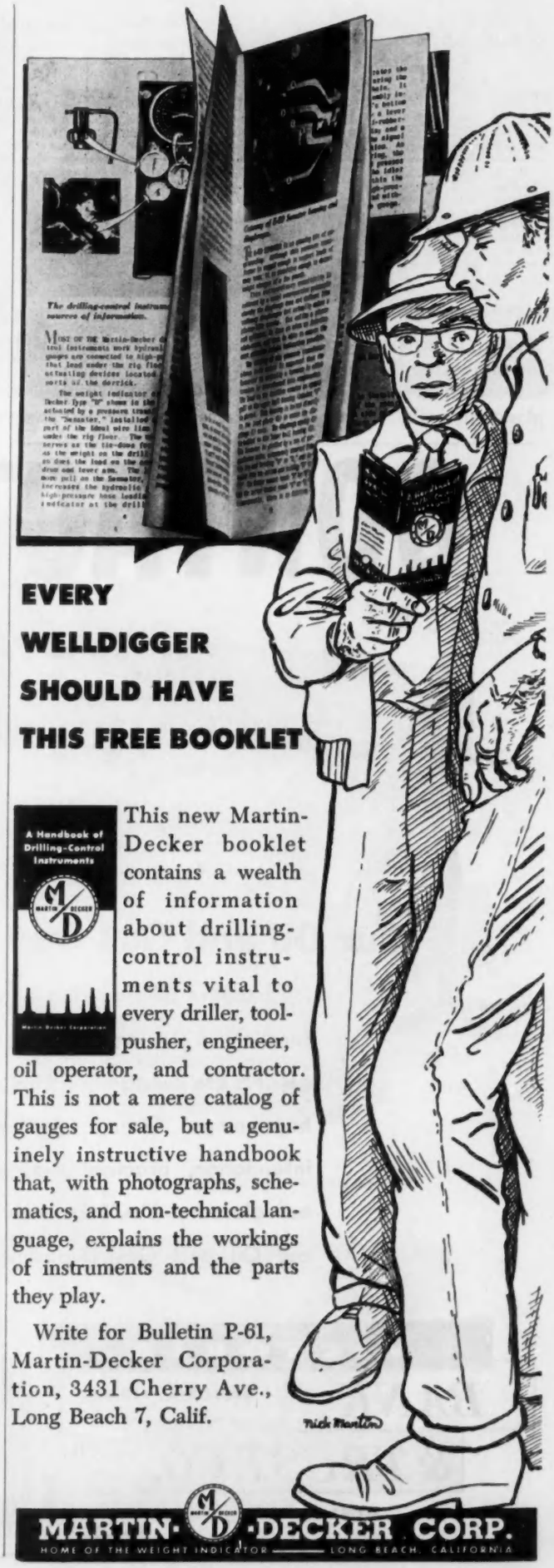


Specimen of log tape indicating saturation with break in zone



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Oil Production and Drilling in Taiwan

Area or Province or Field	Crude Production During 1955 (Barrels)	Natural Gas Production During 1955 (Cubic Feet)	No. of Crude Producing Wells at End of 1955	No. of Natural Gas Producing Wells at End of 1955	No. of Wells Shut in as of December 31, 1955	Amount of Footage Drilled During 1955 (In Feet)	Number of Field Wells Completed During 1955 and Results			No. of Wells Drilling at December 31, 1955	No. of Wildcat Wells Drilled During 1955 and Results		
							Oil	Gas	Dry		Oil	Gas	Dry
Chuhuang Keng	15,719	143,322,000	....	....	....	....	..	..	..	....	..	..	..
Chinshui	2,586	409,506,000	....	....	....	....	..	..	..	....	..	..	..
Chutauchi South Culmination	4,158	109,440,000	....	....	....	....	2	..	2	....	..	..	..
Shantzechiao	1,094	.....	....	....	....	....	..	..	..	....	1	..	..
Chutung	.....	179,411,000	....	....	....	....	..	..	..	....	..	..	..
Liuchunghsi	.....	9,312,000	....	....	....	....	..	..	..	....	..	..	..
Niushan	.....	138,538,000	....	....	....	....	..	..	..	....	..	..	..
Chutauchi South Plunge	.....	17,222,000	....	....	....	....	..	..	..	....	..	..	..
Total	23,557	1,006,751,000	28	25	0	15,782	2	..	2	2	1	..	..

amount of new proved reserves and the production from new areas is only that obtained during testing of exploration wells. Proved gas reserves were put at 2800 Mmcf. as of Jan. 1, 1956.

The few new wells completed during the past two years contributed 41 percent of the crude produced during 1955 and 12.6 percent of 1955's natural gas production. The production rate can be increased a little by development drilling, but a successful result from exploration drilling in 1956 could improve the production outlook substantially.

Exploration survey activities were expanded considerably during 1955 with two geological survey parties maintained continuously in the field. Seismic surveys were begun for the first time in Taiwan early in 1955 by a contract crew from the Teikoku Oil Company, Tokyo, Japan, which also trained a local crew to continue operations after the four-month contract was completed.

Field Activities were supported by the newly-established micropaleontological laboratory which operated at full scale throughout the year, and a sedimentation branch established late in 1955 was engaged in 1956 in both field and laboratory investigations. Subsurface studies for the evaluation of potential prospects also have been intensified, and photogeological interpretation of some critical areas was obtained.

Owing to financial limitations, exploration drilling during 1955 fell behind the rate at which new prospects were being developed by the intensified survey program, and a larger scale drilling program will be required during 1956 to test the prospects already available. Much of the exploration survey activity during 1956 was scheduled to be directed toward evaluating the deeper prospects which are as yet practically untouched. Taiwan's two deepest wells, drilled to 11,500 feet before World War II in the Chinshui field, each has produced more than any other well in Taiwan. Both wells are maintaining their place among the best producers in Taiwan.

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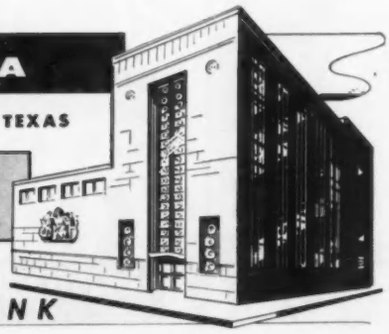

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